PANAMETRICS

Liquid Transducer Installation Guide

Process Control Instrument Division

Liquid Transducer Installation Guide

User's Manual *914-002D*

PANAMETRICS

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Introduction

This guide is for Panametrics flowmeters that measure liquid flow using an ultrasonic transit time method. In this method, two transducers are mounted on a pipe, one upstream of the other. They alternately transmit and receive ultrasonic pulses through the fluid. The pulses that travel in the same direction as the fluid flow (downstream) move slightly faster than the pulses that travel against the flow (upstream). The flowmeter electronics, connected to the transducers, measures how long it takes both the upstream and the downstream ultrasonic pulses to travel from one transducer to the other. This information is used to calculate flow velocity.

Caution!
A flowmeter's accuracy and performance depends on the location, spacing, and alignment of the transducers. This Transducer Installation Guide provides general instructions for locating and installing most transducer types. However, the specific spacing dimension S of your transducers will be unique to your installation.

It is important to note that this installation guide provides information for the most common installations only. However, this guide can also be used for equipment not specifically mentioned here. Panametrics can accommodate many special installations by using different transducers and configurations. For special installations, Panametrics will supply drawings of the nominal dimensions based on the particular application.

This guide consists of the following four sections:

- Description of Flowcell and Transducers
- General Guidelines for Transducer Position and Location
- Installing Wetted Transducers
- Installing Clamp-on Transducers

We suggest that you read the first two sections carefully and then refer to the appropriate section for the type of transducers you are using. If you have any questions or problems, contact Panametrics Applications Engineering or Field Applications Support Team for assistance.

Introduction (cont.)

Upon request, Panametrics can set up in-plant or on-site, hands-on training seminars. For more information, contact your local representative or one of the following Panametrics sales and manufacturing offices:

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Description of Flowcells and Transducers

A **flowcell** is the section of pipe where the transducers are mounted. The flowcell can be created by mounting the transducers on the existing pipeline, or on a **spoolpiece**. A spoolpiece is a precision-manufactured section of matching pipe that contains the ports where the transducers will be mounted. This setup allows more accurate transducer alignment before mounting the spoolpiece into the pipeline. If requested, the spoolpiece can be calibrated.

Transducers fall into one of two major classes: wetted or non-wetted. Wetted transducers are inserted into the pipe so that they come in direct contact with the fluid being measured. Non-wetted transducers, commonly referred to as clamp-ons, are clamped on the outside of the pipe and send their ultrasonic pulses through the pipe wall.

Panametrics standard wetted transducers are typically flat-faced and send their ultrasonic longitudinal wave signals into the fluid with no refraction. Panametrics standard clamp-on transducers, on the other hand, use refraction to transmit sound through the pipe wall and into the liquid. Although 3/8-, 1/2-, 3/4-, and 1-in. transducer diameters are most common, a variety of other sizes is available, depending on the application.

Panametrics has also developed hybrid transducers that consist of two parts: a fixed member and a removable, wetted transducer. The fixed member is a special wetted pipe plug called a Pan-Adapta® plug. This plug (fixed member) is mounted in the flowcell. The wetted transducer can be temporarily and repeatedly coupled to the outside face of the Pan-Adapta plug. In using the Pan-Adapta plug there is no need to interrupt the process when servicing the hybrid transducer.

For high-temperature applications, the Bundle Waveguide Technology™ (BWT) system can be used. The BWT system consists of a Pan-Adapta plug and a transducer. The Pan-Adapta plug uses waveguide bundles to efficiently concentrate a greater amount of the transducer signal into the process. At the same time, it acts as a heat buffer that protects the transducer from high temperatures to ensure long life.

General Guidelines for Transducer Position and Location

Whichever transducer type is selected for your installation, flowmeter accuracy depends on proper transducer location, spacing, alignment, and electronics programming. However, even though every transducer installation has specific location considerations, the following two-location guidelines apply to all transducers, regardless of type:

1. To help assure a uniform flow profile, locate the flowcell so that there are at least 10 pipe diameters of straight, undisturbed pipe upstream and 5 pipe diameters of straight, undisturbed pipe downstream from the point of measurement. Measure from the center of the transducer at the pipe wall ID. “Undisturbed pipe” means avoiding sources of turbulence such as valves, flanges, elbows; avoiding swirl; and avoiding cavitation.

2. It is important to locate the transducers on a horizontal plane. This specifically applies to mounting transducers on a horizontal pipe. One transducer cannot be on top of the pipe and one on the bottom, because the top of the pipe tends to accumulate gas and the bottom tends to accumulate sediment. These can attenuate or block the ultrasonic signal. There is no similar restriction with vertical pipes. To ensure a full pipe, however, you should avoid vertical downward flow. When using a wetted installation, extended-well type transducers are preferred to keep the transducer face free from gas or sediment that may tend to get trapped in the transducer port.

Installing Wetted Transducers

There are two basic types of flowcell installations for wetted transducers:

- Tilted Diameter - for use with pipe sizes of approximately 50 mm ID (2 in. pipe) and above.
- Axial Offset - for use with pipe sizes of 50 mm ID (2 in. pipe) and below. In practice, approximately 1 to 50 mm ID (.04 to 2 in. ID) pipe sizes are included.

Tilted Diameter Flowcells

A tilted diameter flowcell is so named because the transducers send their pulses at a typical 45° angle across the diameter (or other chord) of the pipe. This type of flowcell can be configured as a single-traverse or multiple-traverse installation.

Note: *a. The mounting angle for the transducer is typically 45°, but other angles (20°, 30°, or 60°) can be used as required.*

b.Tilted diameter can also refer to paths that are off-diameter such as the Mid-Radius path.

A single-traverse configuration consists of two transducers mounted on opposite sides of the pipe so that the signal they transmit passes through the fluid just once, at a typical 45° angle (Figure 1 below).

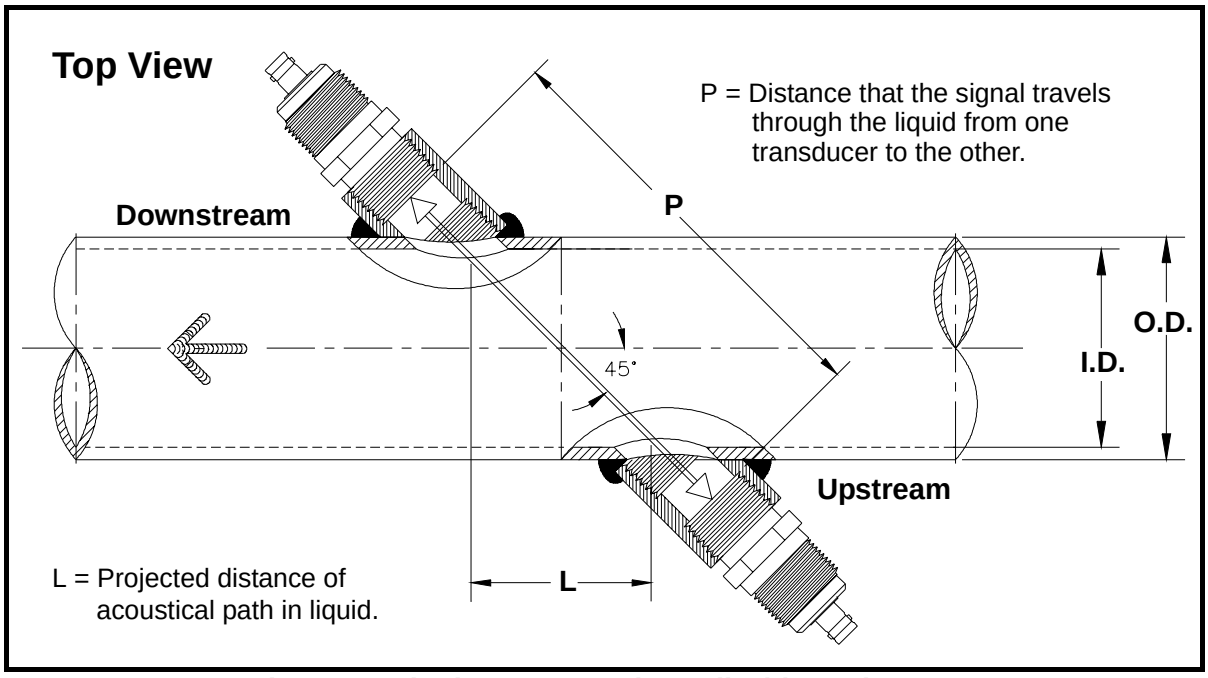


Figure 1: Single-Traverse Flowcell with L=Pipe I.D.

Tilted Diameter Flowcells (cont.)

A multiple-traverse configuration consists of two transducers mounted on the pipe so that the signal traverses the fluid two or more times before reaching the other transducer. See Figures 2 to 4, below, for examples of commonly used installations.

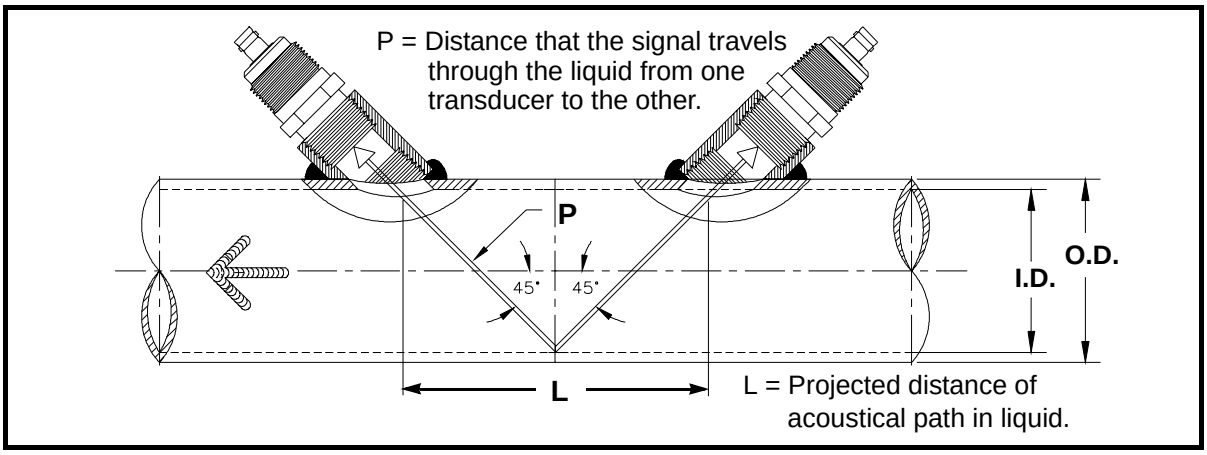


Figure 2: Double-Traverse Flowcell

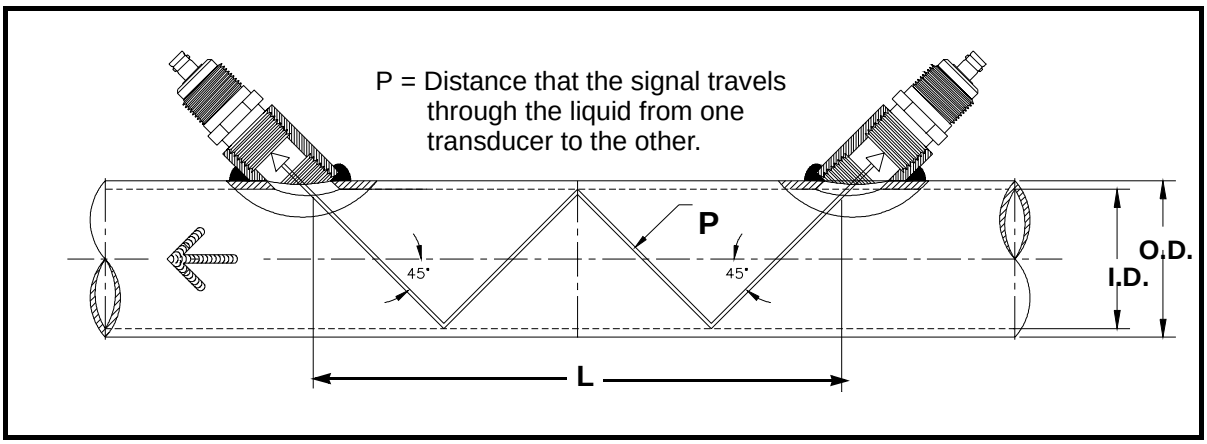


Figure 3: Multiple-Traverse Flowcell (Four Traverses)

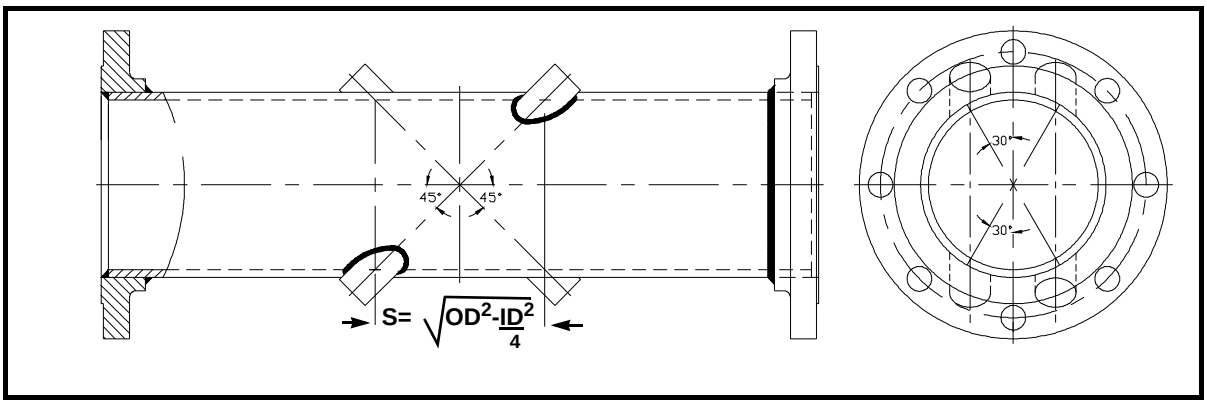


Figure 4: Mid-Radius, Single-Traverse, 2-Path Flowcell

Axial-Path Offset Flowcells

In axial-path offset flowcells, the walls of the pipe reflect the ultrasonic signal. This allows the signal to remain in the fluid longer, increasing the effective length L and path P of the signal, thus increasing accuracy. The number of times the signal can traverse the fluid depends on such factors as transducer frequency, pipe size, pipe wall condition, and the fluid being measured.

Axial-path offset flowcells can be made up as a spoolpiece, then mounted into the pipeline, or they can be created by cold tapping the transducer ports directly into the existing pipeline.

Figure 5 below shows an axial-path offset flowcell that is used for 1/8- to 2- in. pipe sizes. This type of flowcell maintains accuracy of measurement on small diameter pipes because it provides a much longer path length and allows for 100% area averaging of the flow profile. An axial-path offset flowcell can be installed into the pipeline using flanging, welding, NPT threading, or quick-release methods, as necessary. When installed, the flowcell should be positioned to avoid gas entrainment or sediment deposition in front of the transducers.

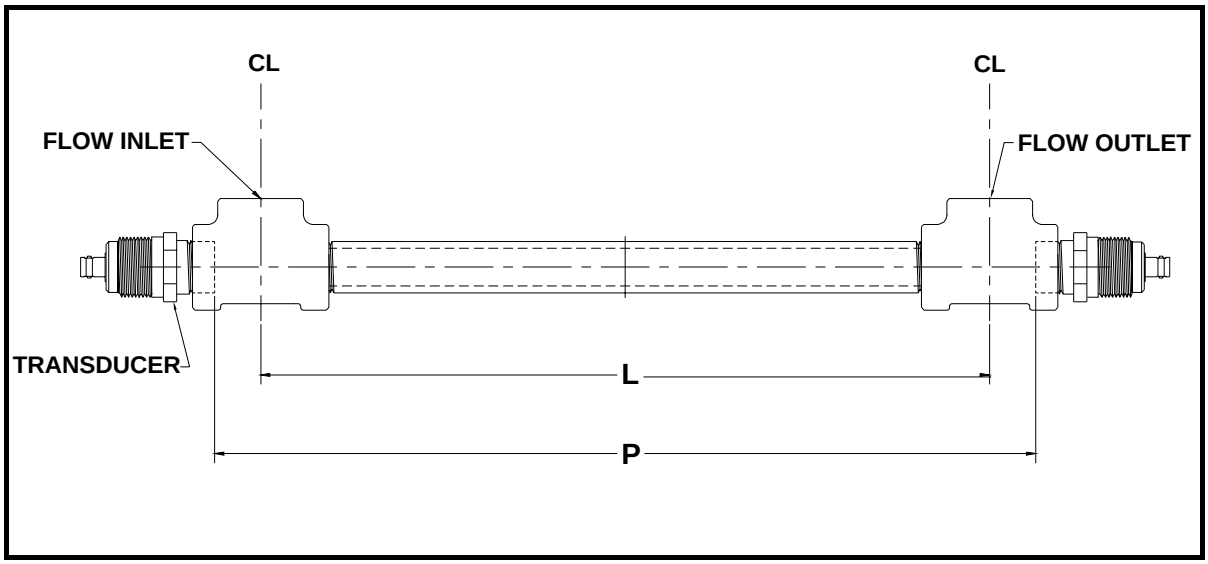


Figure 5: Axial-Offset Flowcell

Creating Flowcells

This section describes how to create a flowcell using one of two following methods:

- Installing a spoolpiece
- Cold tapping transducer ports into an existing pipeline

Note: *Hot tapping of pressurized pipe is also possible. Contact Panametrics for the separate equipment and instructions.*

Installing a Spoolpiece

Spoolpieces can be either flanged or welded into the existing pipeline. To position the spoolpiece into the pipeline (Figure 6 below):

1. Find the arrow mark and the word TOP marked on the data tag on the spoolpiece. If the spoolpiece is flanged, two bolt holes should straddle the centerline.

2. Place the spoolpiece in the pipeline so that the arrow mark is in the direction of flow and the top is appropriately located. (Be sure the transducer ports are in a horizontal plane.)

3. Bolt or weld the spoolpiece into place, as appropriate.

4. Go to the section that describes mounting the wetted transducers.

In general (including cases where the spoolpiece axis is not horizontal), be sure that the installation does not allow gas or sediment to deposit in the transducer ports. Otherwise the sound waves will be attenuated or blocked entirely.

Note: *Use extended-well transducers or extended-well Pan-Adapta plugs for tilted diameter flowcells.*

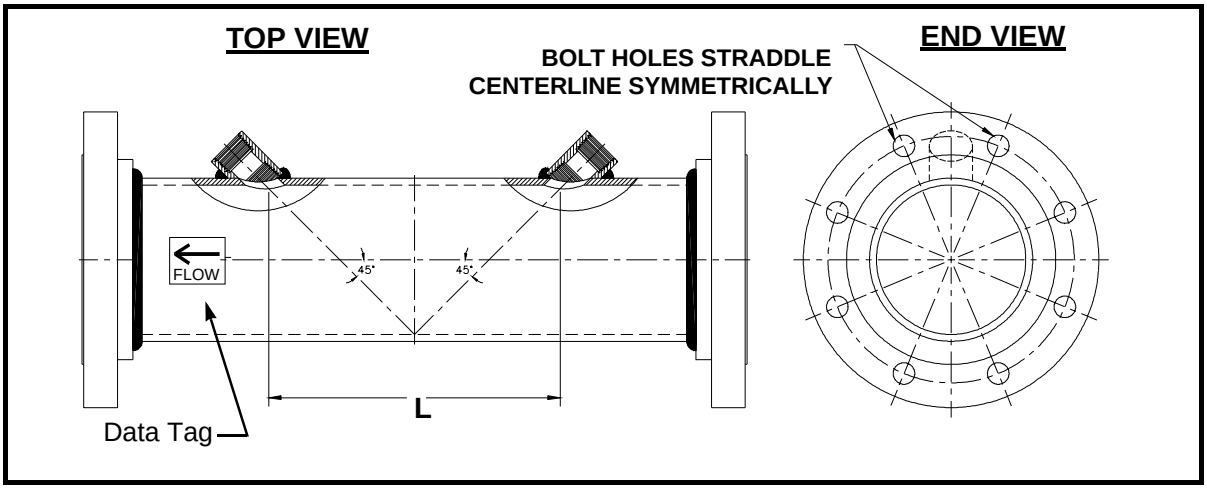


Figure 6: Top View of a Flanged Spoolpiece

Cold Tapping into an Existing Pipeline

To cold tap the transducer ports into a pipe, the pipe must be empty and safe. Please note that there are reference drawings and kits for cold tapping available (see Figure 9, page 11). Standard kits provide alignment equipment for single-traverse installations only. The following steps are general guidelines required to make a cold tap to install the transducer ports:

!WARNING!
Be sure to follow all applicable safety codes and safety procedures.

A. Welded Pipe

1. Measure and mark locations on the pipe where the transducer ports are to be placed.
2. Cut two holes into the pipe at the port locations. This is usually done by using a welding torch or drilling with specialized equipment.
3. Place a rod through the two holes to help maintain the alignment while you attach a contoured coupling or nozzle to each hole. Use rod support bushings to hold the rod in the couplings or nozzle (Figure 7 below).
4. Weld the couplings to the pipe.
5. Remove the rod and bushings from the pipe. (Now refer to the next section on mounting the transducers.)

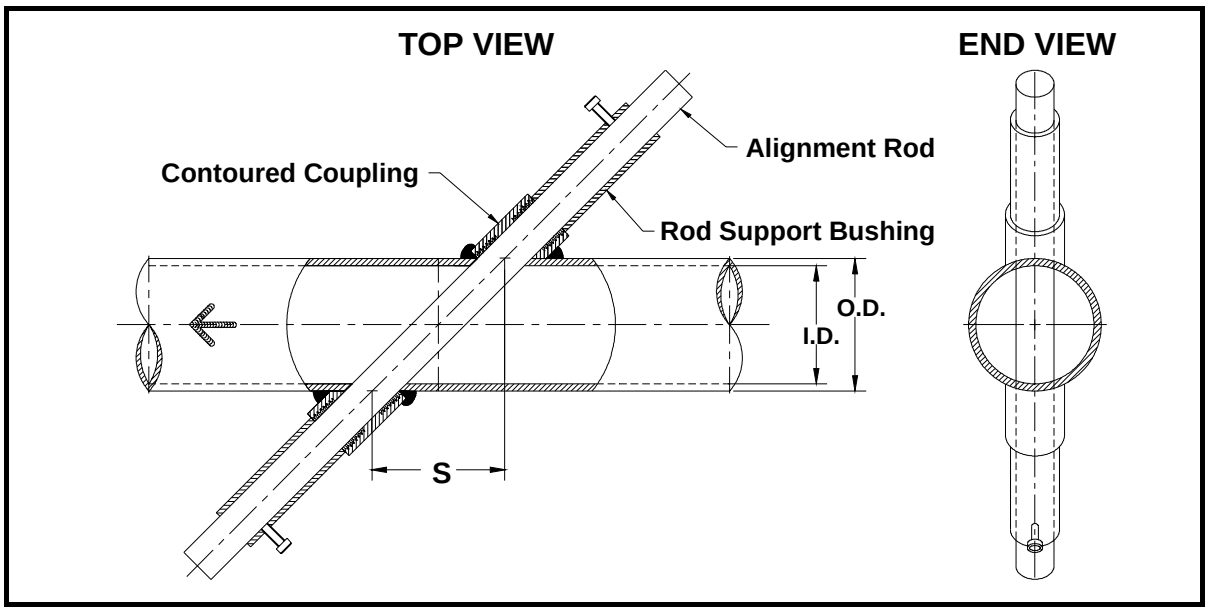


Figure 7: Transducer Location for a Cold Tap (Single-Traverse Only)

B. Non-Weldable Pipe

1. A saddle is used to attach a coupling to non-weldable pipe such as wood, fiberglass, cement, concrete, cast iron, etc.

2. Measure and mark locations on the pipe where the transducer ports are to be placed.

3. Cut or drill the two holes into the pipe at the port locations. The may require special equipment such as templates or drill guides.

4. Prepare the pipe surface around the hole so that the O-ring seal in the saddle will form a good seal. In many cases, this can be done by coating the pipe with epoxy.

5. Place a rod through the two holes to help maintain the alignment while you attach a contoured coupling or nozzle to each hole. Use rod support bushings to hold the rod in the couplings or nozzle (Figure 8 below).

6. Fully install saddle and tighten saddle bolts.

7. Remove rod and bushings and install transducers.

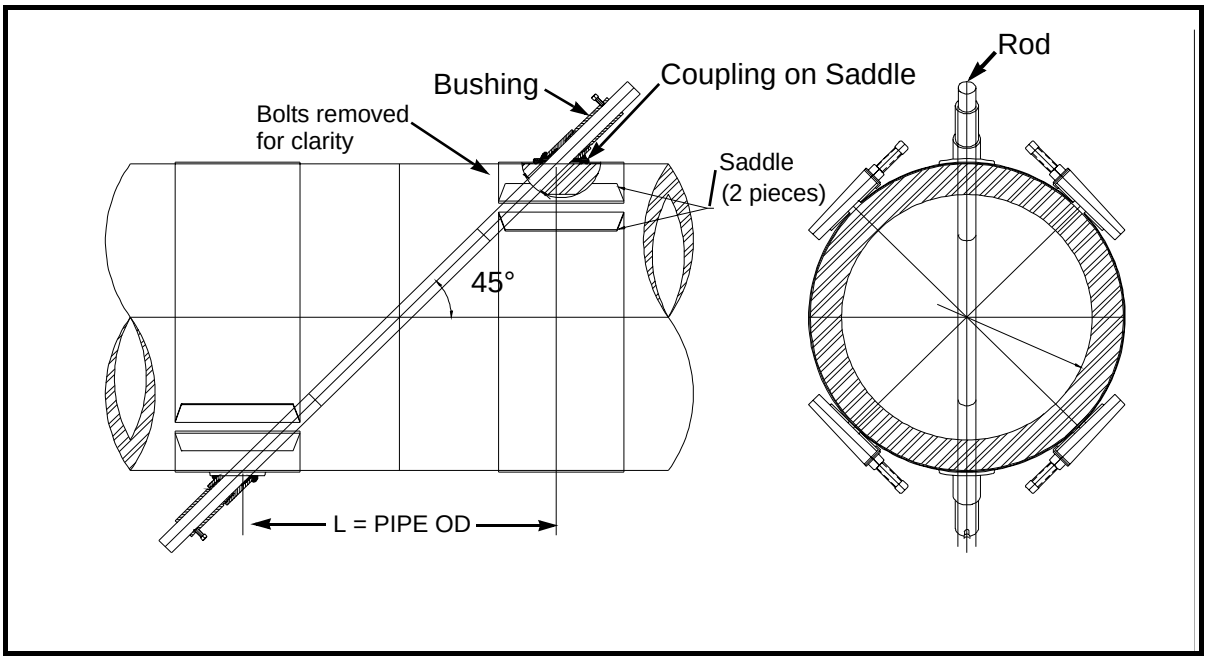


Figure 8: Non-Weldable Pipe with Attached Saddle

Cold Tapping into an Existing Pipeline (cont.)

Figure 9, below, shows a typical cold tapping kit. Each kit contains the following:

- 2 Couplings
- 2 Rod Support Bushings
- Rod Segments
- Allen Wrench
- Detail drawings

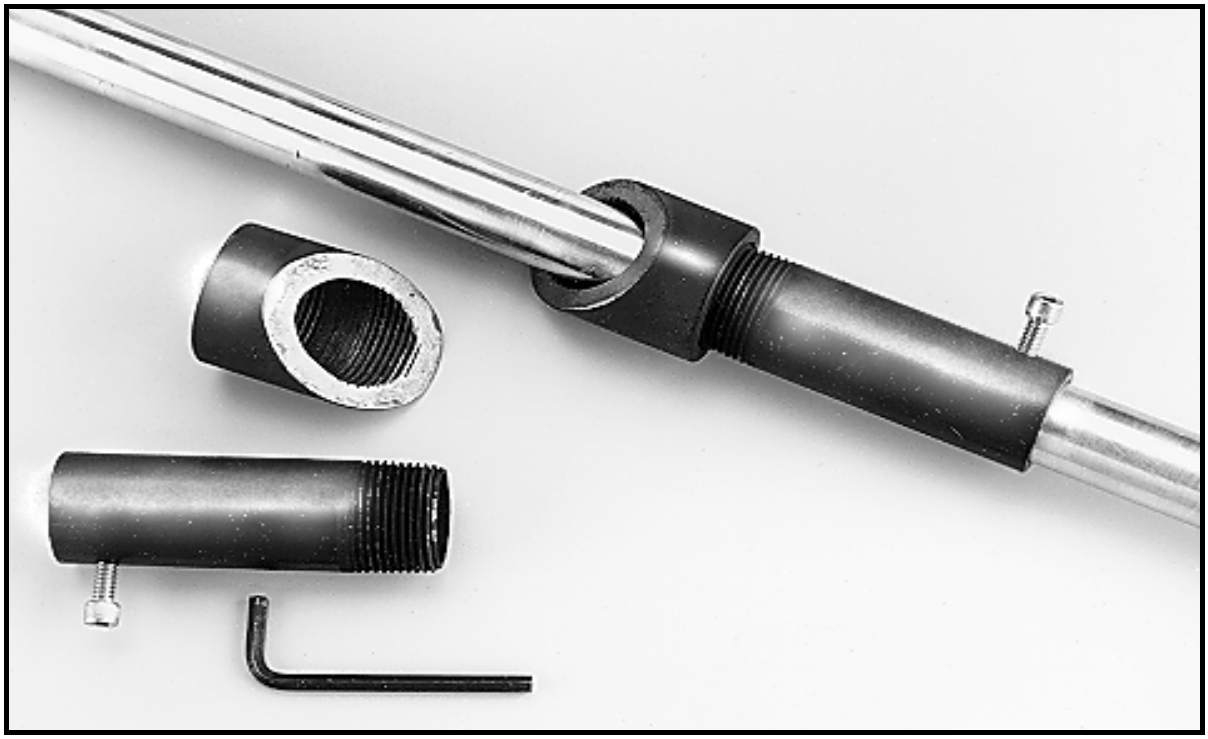


Figure 9: Cold Tapping Kit

Cold Tapping into an Existing Pipeline (cont.)

Note: *Two nozzles (flanged) are available for cold tapping ports for flanged transducers or Pan-Adapta plugs. The kit for the nozzles includes two tapped flanges to accept the bushings (Figure 10 below).*

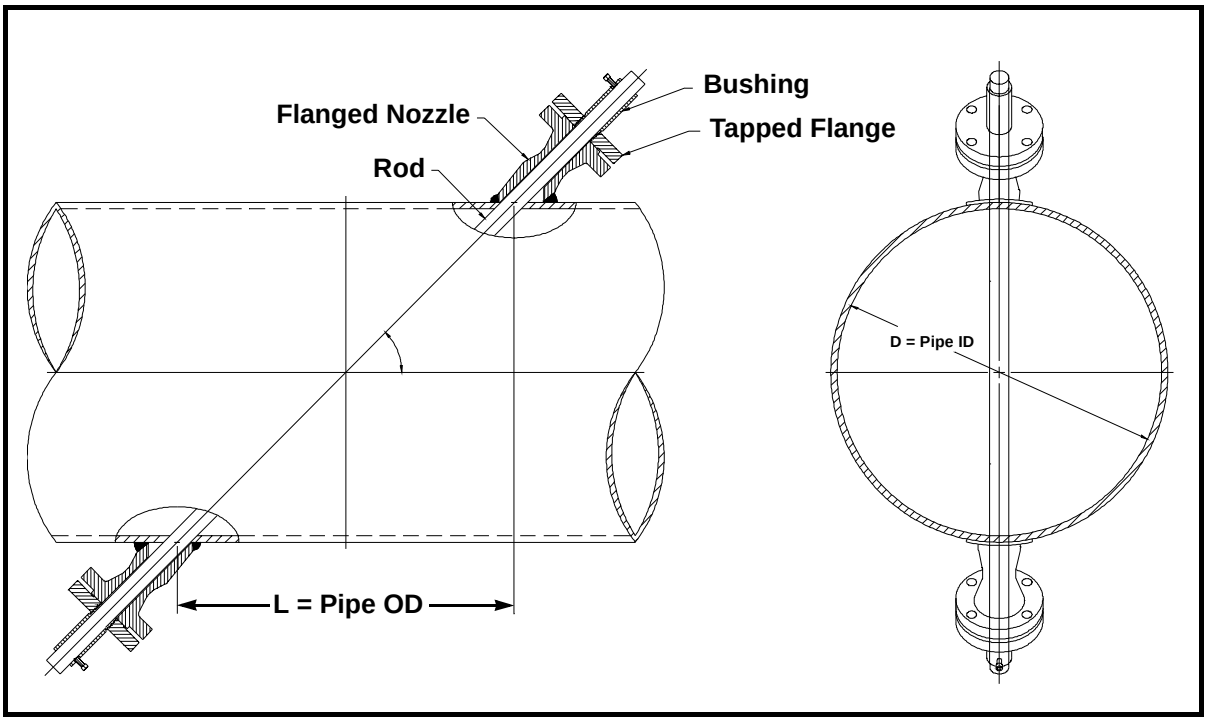


Figure 10: Flanged Nozzles for Cold-Tapping

Mounting Transducers into the Flowcell

Standard transducers (Figure 11 below) and extended-well transducers (Figure 12 below) typically have a 3/4-in. or 1-in.NPT thread for the transducer-to-spool piece connection and for the junction box connection, to protect the electrical connector.

Note: *Transducers and Pan-Adaptas are marked with an inspection number, a serial number, and a programming number. Make a note of the programming number: it will be needed for programming the meter.*

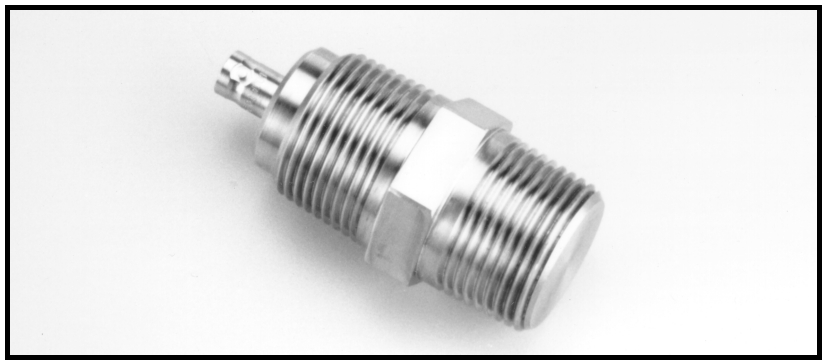


Figure 11: Standard Wetted Transducer

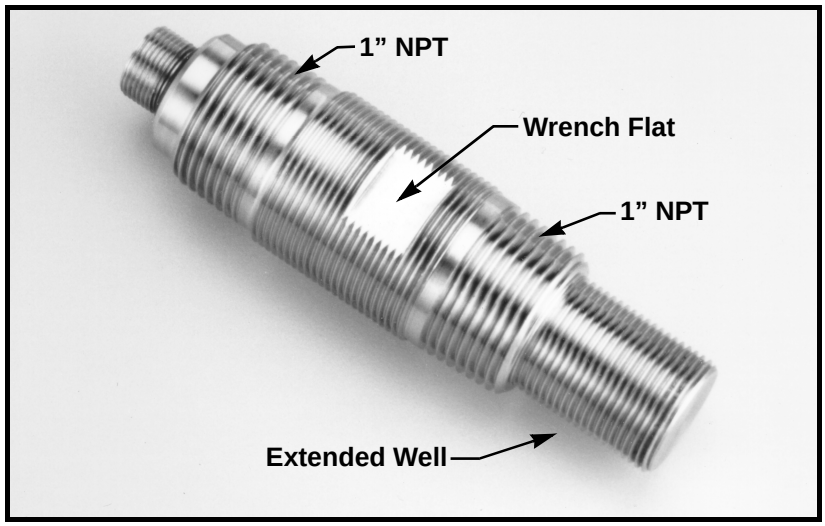


Figure 12: Extended-Well Transducer

Mounting Transducers into the Flowcell (cont.)

Standard and extended-well transducers are easily modified for hazardous areas by adding explosion-proof junction boxes (Figure 13 below).

!WARNING!
Be sure to follow all applicable safety codes and safety precautions when installing transducers in hazardous areas.

To weatherproof the transducers, you can use the same junction box with the supplied O-ring seal.

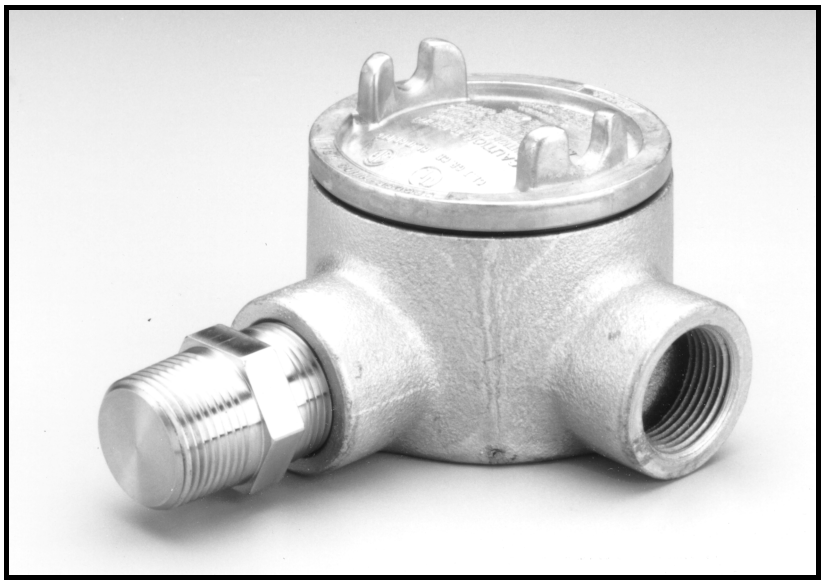


Figure 13: Wetted Transducer in Junction Box

Mounting Transducers into the Flowcell (cont.)

Buffer rod transducers are used in high- or low-temperature applications and are typically 6 in. long and have a 1-in. NPT thread for the process connections. Figure 14 below shows a standard 6-in. buffer rod transducer.

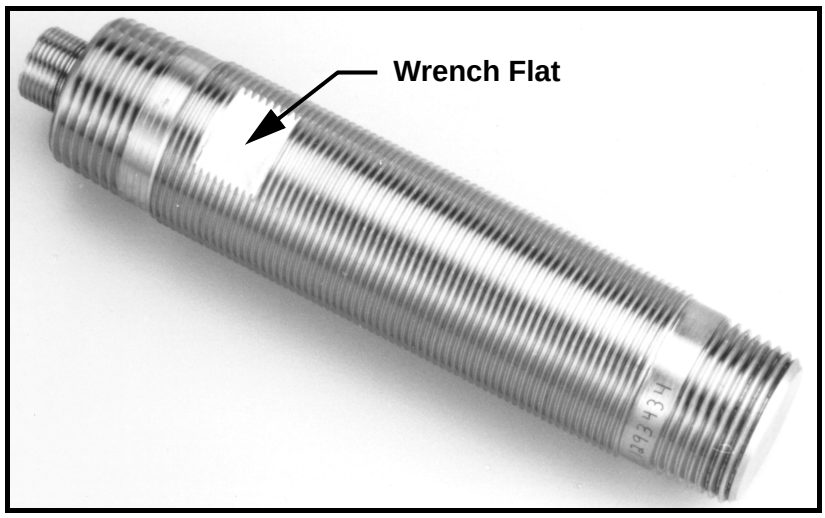


Figure 14: Buffer Rod Transducer

To mount the transducers or transducer-bearing Pan-Adaptas into a flowcell, screw them into the mounting ports, using approximately three layers of Teflon tape or other appropriate thread sealant (Figure 15 below). Tighten the transducer or Pan-Adapta with a wrench to ensure the mounting will be leak-proof. Be sure to use the wrench only on the hex nut of the standard transducer or the flats of the buffer rod transducer.

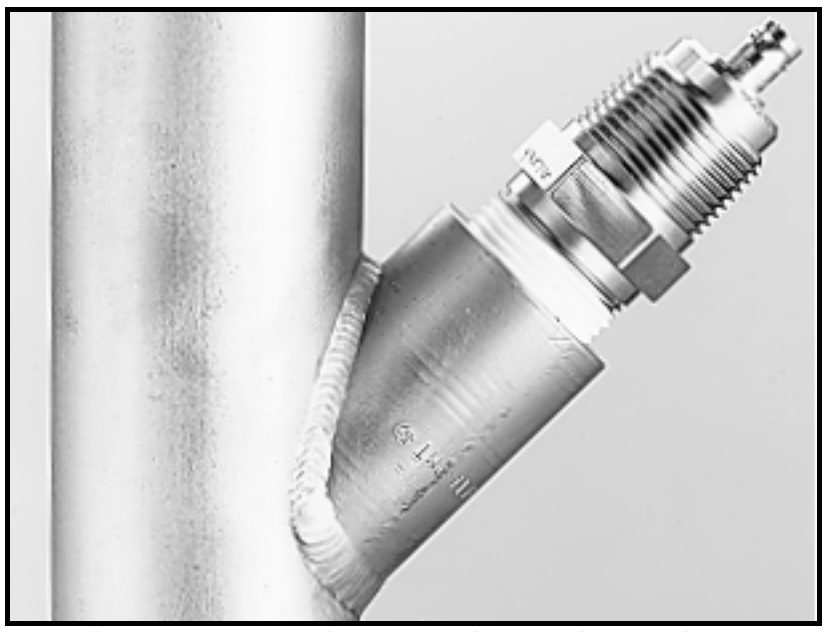


Figure 15: Properly Mounted Wetted Transducer

Using Pan-Adapta Precision Plugs

The Pan-Adapta plug is a pipe plug and coupling assembly made of stainless steel, other metals, or a plastic such as CPVC, PVDF, or PTFE. The Pan-Adapta plug mounts into pipe couplings, nozzles, or tees, enabling you to install and remove transducers easily without interrupting the process or emptying the pipe.

Stainless steel and other metal Pan-Adapta plugs are screwed, socket-welded, or flanged into the pipe coupling, nozzle or tee.

Plastic Pan-Adapta plugs are mounted into a pipe coupling either by threading or fuse bonding. Plastic Pan-Adaptas are used when wetted parts cannot be metal. These adaptors have a thinner face than the stainless steel plugs and require the use of extended-well wetted transducers.

Figure 16 below shows standard threaded stainless steel and plastic Pan-Adapta plugs. Figure 17 below shows extended-well threaded stainless steel Pan-Adapta plugs.

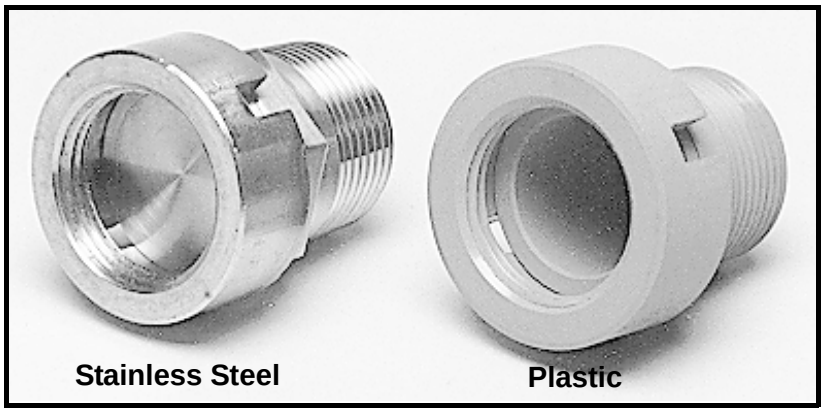


Figure 16: Standard Threaded Stainless Steel (left) and Plastic Pan-Adapta Plugs

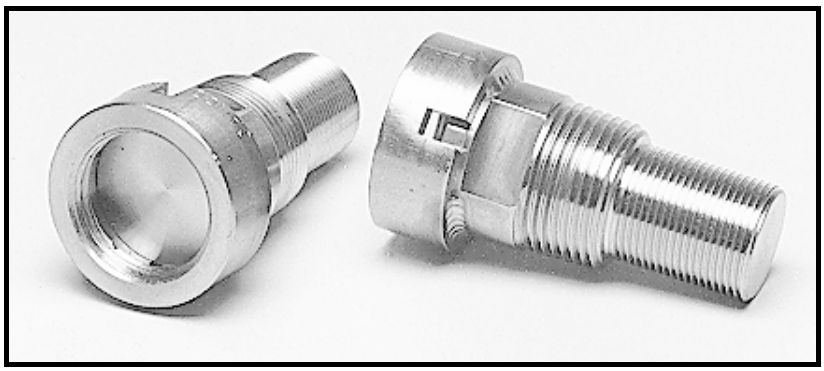


Figure 17: Extended-Well Threaded Pan-Adapta Plugs

See Figures 18 and 19, page 17, for an example of a threaded Pan-Adapta plug and transducer mounted in an offset flowcell and a spoolpiece flowcell, respectively.

Using Pan-Adapta Precision Plugs (cont.)

Installation procedure:

1. Installing Pan-Adapta Plugs

- **Threaded type:**
  Use a thread sealant such as Teflon tape on the Pan-Adapta threads and screw it into the flowcell transducer port (Figures 18 and 19 below), using the appropriate torque.

- **Welded type:**
  Socket-weld the Pan-Adapta plug into the port (Figure 20, page 17). If a plastic type is used, fuse bonding or glue is required.

- **Flanged type:**
  Using the appropriate gasket, bolt the flanged Pan-Adapta plug into the nozzle (Figures 21 and 22, pages 19 and 20). Use a torque appropriate for the flange, gasket, and application rating.

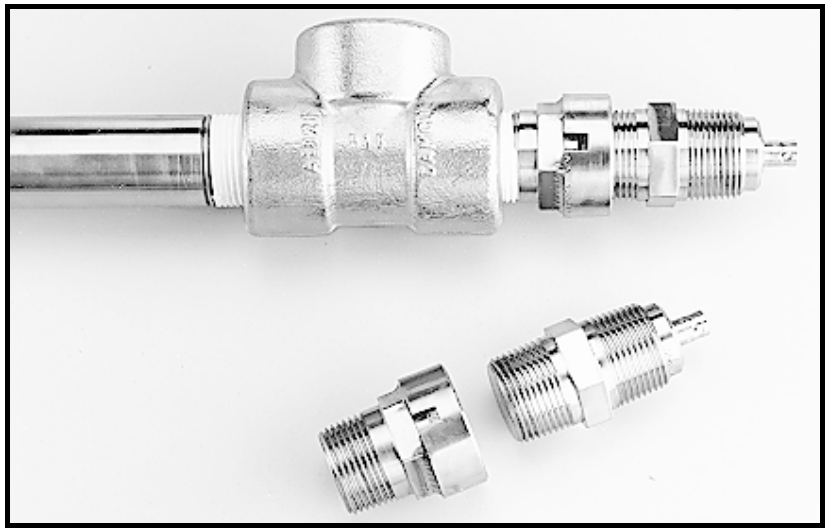


Figure 18: An Axial Offset Flowcell Installation

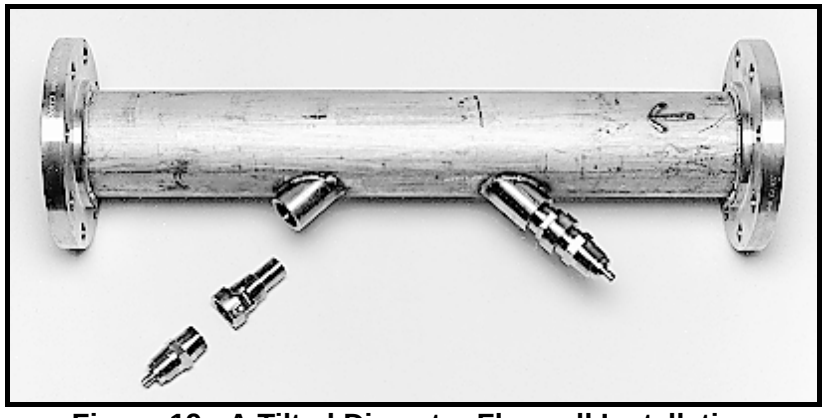


Figure 19: A Tilted Diameter Flowcell Installation

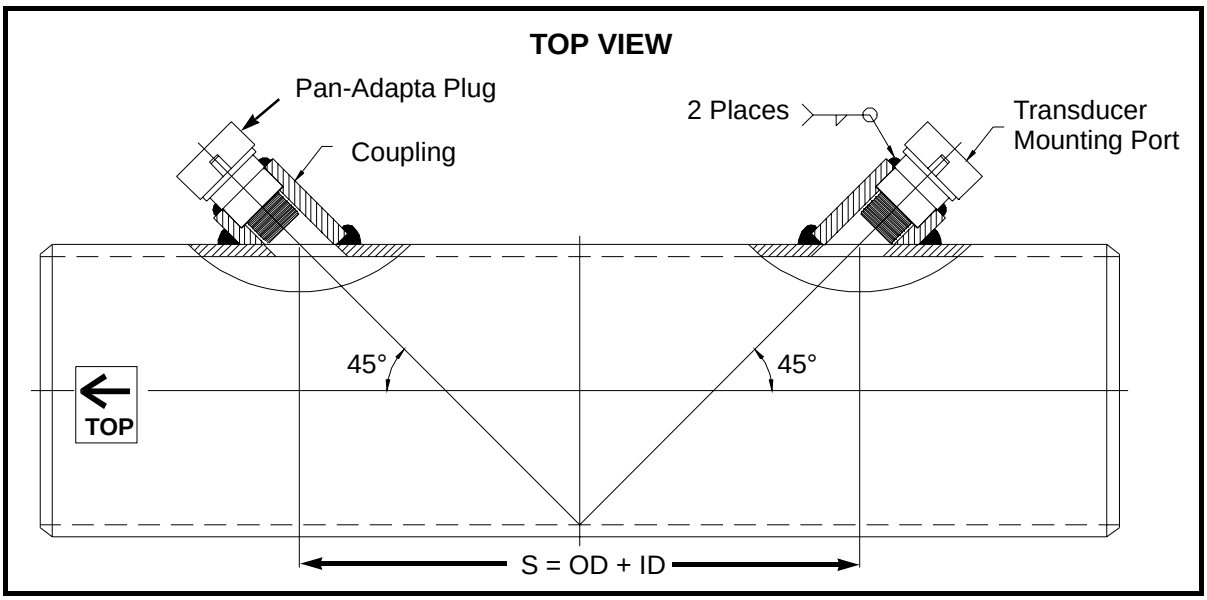
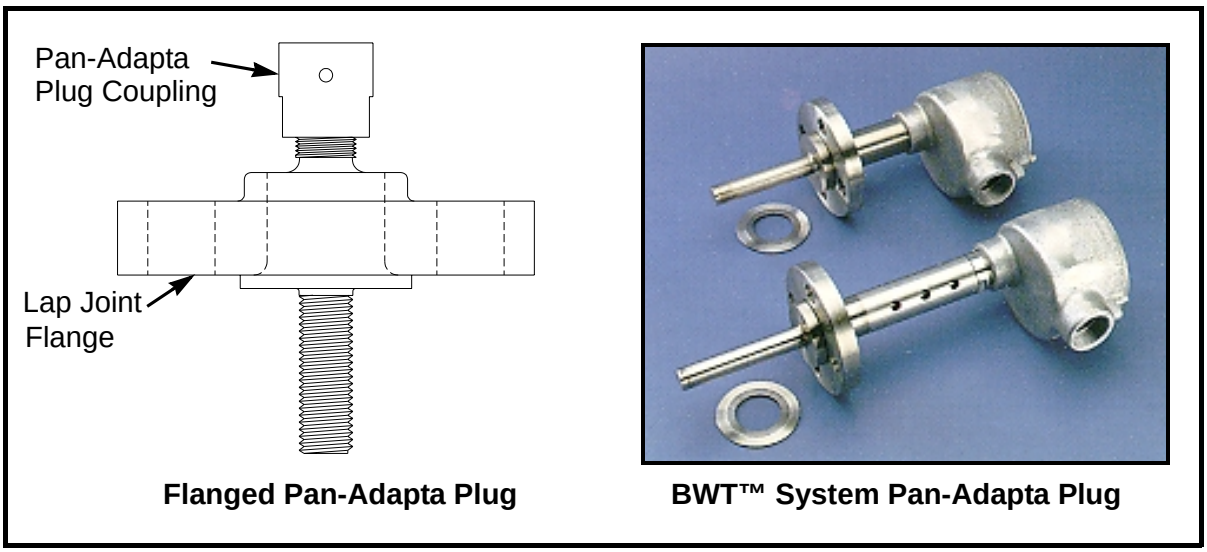


Figure 20: Pan-Adapta Plugs Socket-Welded in Spoolpiece Flowcell



Flanged Pan-Adapta Plug

BWT™ System Pan-Adapta Plug

Figure 21: Types of Flanged Pan-Adapta Plugs

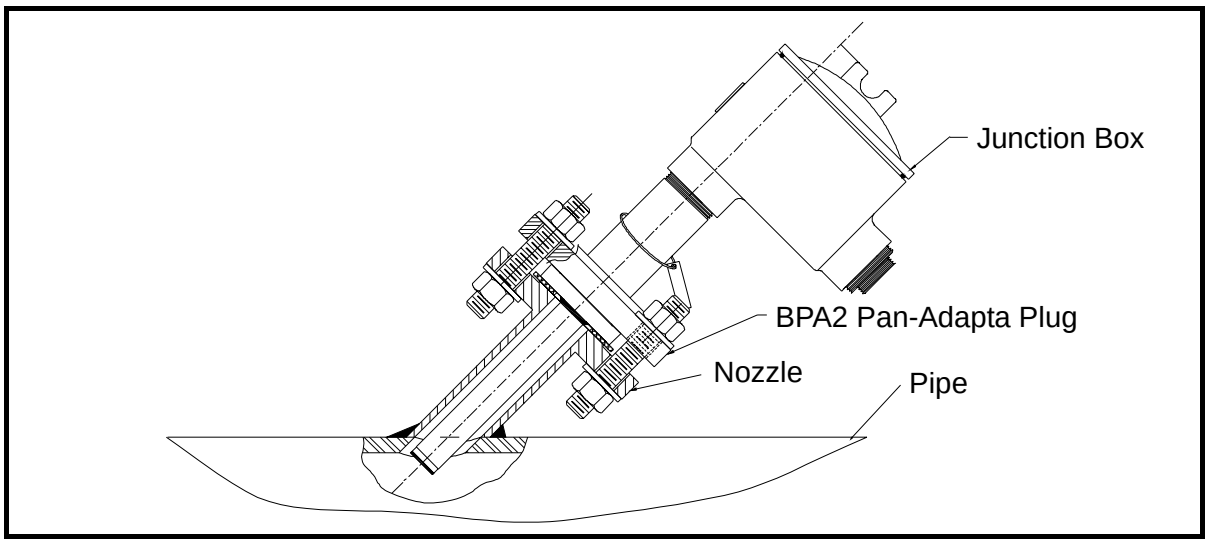


Figure 22: Flanged Pan-Adapta Plug in Flowcell Nozzle

Using Pan-Adapta Precision Plugs (cont.)

2. Put couplant on the flat face of the transducer and screw it into the Pan-Adapt plug. Hand-tighten, then further torque to 50 ft-lb for steel, or 10 ft-lb for plastic.

IMPORTANT: *Be sure to use an ultrasonic couplant on the face of the transducer before installing into the Pan-Adapta plug.*

The Pan-Adapta plug forms part of the pressure boundary to the process stream. Extreme care must be taken to ensure that the plugs are properly installed.

!WARNING!
All applicable safety codes and safety procedures must be followed when installing or removing the plugs.

When removing the transducers from the Pan-Adapta plugs, be sure the plugs are held securely in place. Keep the immediate work area clear of insulation or other visual interference, so that you can clearly see the threaded items.

1. Verify that the **plug** portion is leak-tight.

2. Hold the Pan-Adapta plug securely in place with a wrench. Use a second wrench to unthread the transducer.

Installing Clamp-On Transducers

In general, installation of clamp-on transducers consists of mounting the clamping fixtures to the pipe and then mounting the transducers into the clamping fixtures.

When installing transducers in non-wetted applications, you can use one of the following types of devices to hold the transducer against the pipe wall:

- Universal clamping fixture
- General clamping fixtures: Block style, Yoke and Strap
- Magnetic clamping fixture
- Small clamping fixtures (6-in. and 12-in. long, with Velcro straps)

Virtually all standard transducers can be used with these installation devices.

Clamp-On Transducer Types

The most common types of Panametrics clamp-on transducers are the weatherproof shear wave and the weatherproof/hazardous area shear wave transducers.

Each type of transducer has a flat face and is used for 2-in. diameter pipes and larger. Panametrics also supplies other transducers for smaller pipes. Pipes can be made of carbon steel, stainless steel, copper, brass, cast or ductile iron, glass, plastic (PVC or CPVC), or fiberglass. There are no thickness constraints on the pipe wall, as long as the wall can conduct sound adequately. For small pipes, see page 35 for small clamping fixtures.

Figure 23 below shows the most common types of transducers.

Figure 23: Four Types of Clamp-On Transducers

Clamping with Stainless Steel Straps

Figures 24 and 25, below, show dual- and single-traverse fixtures, respectively, with stainless steel straps.

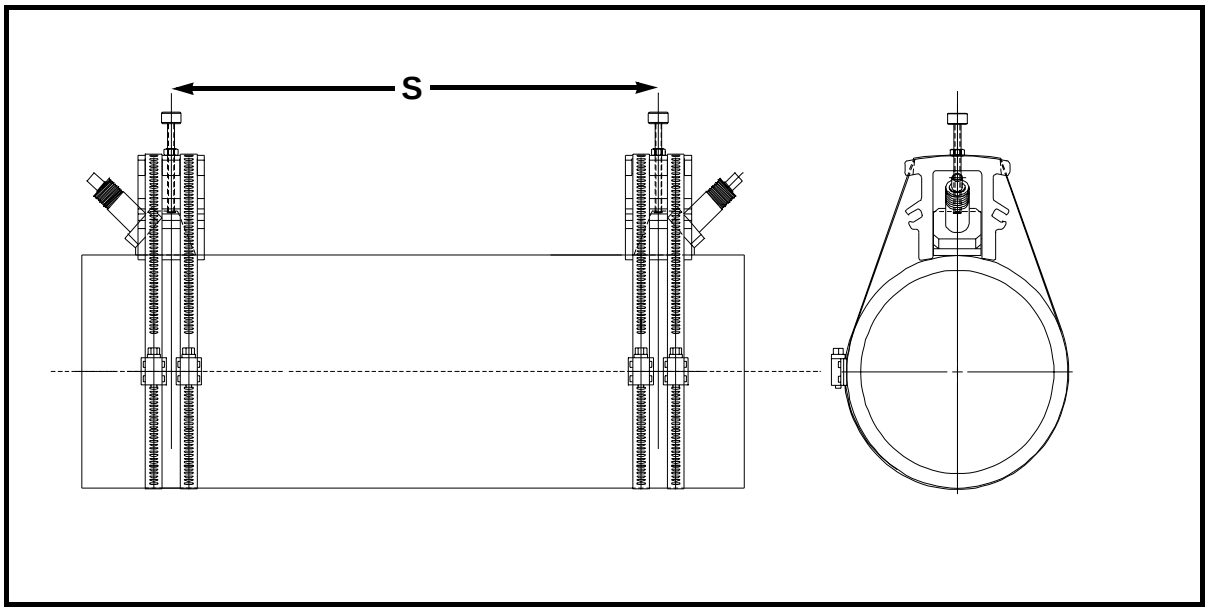


Figure 24: Dual-Traverse Clamping Fixtures with Stainless Steel Straps

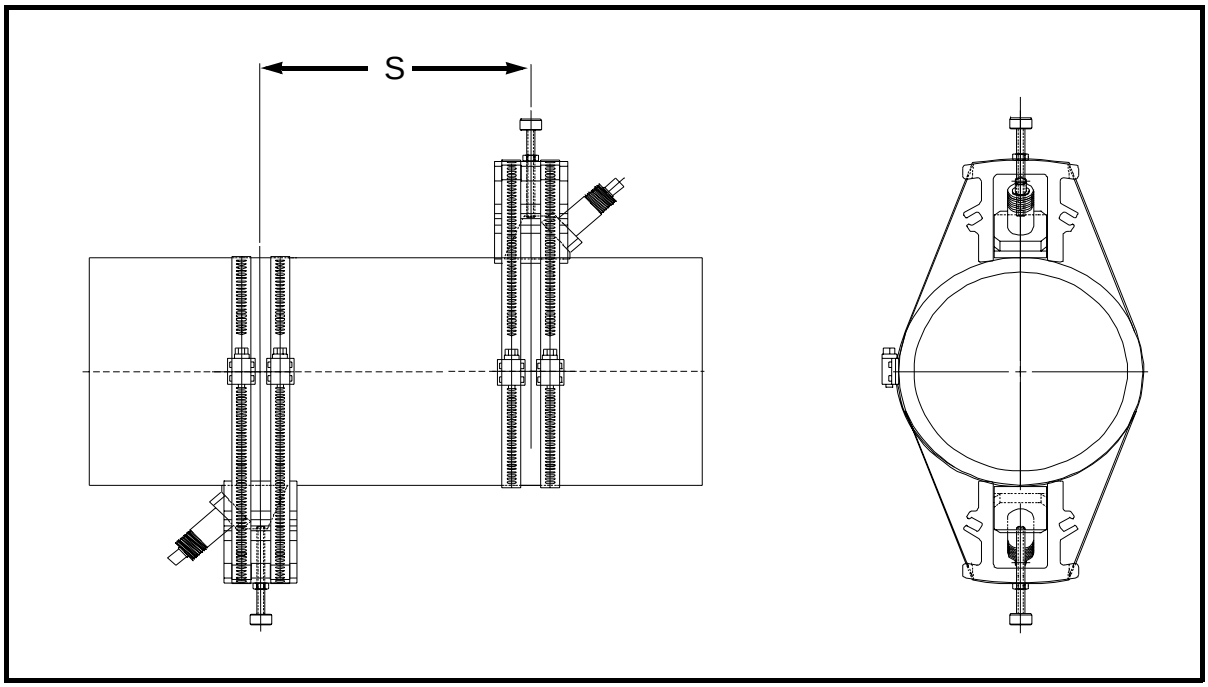


Figure 25: Single-Traverse Clamping Fixtures with Stainless Steel Straps

Couplants

Panametrics supplies an ultrasonic couplant for your clamp-on installation. The purpose of the couplant is to provide reliable transmission of ultrasound between two adjacent solid surfaces. Generally speaking, couplants perform this task by excluding air from between the adjacent surfaces. Accordingly, the clamp-on transducers should be pressed tightly against the pipe, using hand pressure on the set screw to squeeze the couplant to as thin a film as practical for the given pipe surface.

The most commonly used couplants in ultrasonic testing are ordinarily satisfactory for any short-term clamp-on flowmeter application. These couplants include, in general order of preference: gels, grease, propylene glycol, oil, glycerine, and water. Long-term couplants include grease, epoxy adhesive, and solid rubber-like sheet couplant.

Panametrics provides couplants for both permanent and temporary use as well as for high- and low-temperature applications. For long-term installations, make sure the couplant does not dry or run out.

Standard couplants supplied from Panametrics are listed in Table 1 below.

Table 1: Couplants

PART NO.	TYPE	TEMP. RANGE	USE
CPL-1	Standard	-40 to +65°C	Semi-Permanent
CPL-2	High/Low Temperature	-160 to +260°C	Semi-Permanent
CPL-3	For Portable	-20 to +60°C	Temporary
CPL-4	Special	As Required	* Difficult Applications
CPL-7	Epoxy	-10 to +50°C	Permanent
CPL-8	Solid Sheet	-40 to +230°C	Permanent

***** Installations involving hotter or colder temperatures then listed above, may require special couplants. Consult Panametrics for these applications.

Determining the Transducer Locations

The first step in the installation is determining the location of the transducers. The transducers can be mounted using one of two methods (also see Figure 26 below):

- Double-traverse method where the transducers are mounted on the same side of the pipe and the ultrasonic signal is bounced from one transducer to the other, off the opposite wall.
- Single-traverse method where the transducers are mounted diagonally across from each other. The ultrasonic signal is transmitted directly from one transducer to the other, across the pipe.

For pipe diameters from 1- to 20-in., always try the double-traverse method because it is easier to configure and yields greater accuracy. However, if the pipe has poor inside surface conditions or the fluid is highly attenuating, you may not be able to obtain a reliable signal. Therefore, you should use the single-traverse method. Typically, you should try the single-traverse method for pipe diameters greater than 20-in. Spacing of the transducers is calculated by the electronics after all the installation parameters have been programmed into the flowmeter.

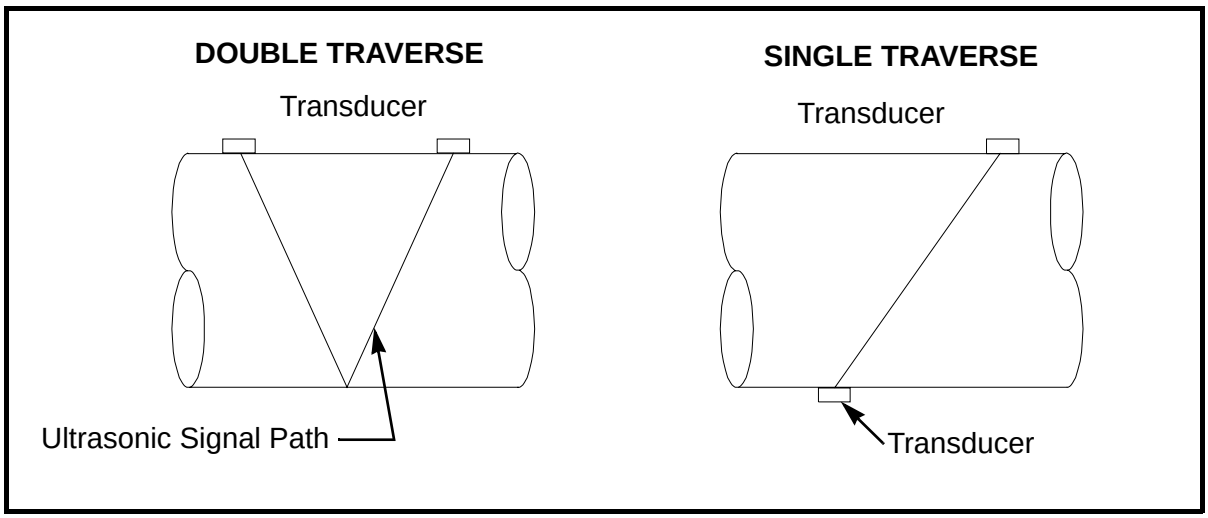


Figure 26: Double- and Single-Traverse Installations

Using the Universal Clamping Fixture

The Universal Clamping Fixture acts as a spacing device and a transducer holder. The fixture has two short blocks that are used for the double-traverse method. Two slide tracks connect the two blocks. A ruler attached to one of the tracks helps set the transducer spacing. For double-traverse methods, a long block is also used.

The blocks are used to hold the transducers in position for accurate measuring. The clamping fixture is chained or strapped around the pipe. The blocks are positioned properly using the spacing dimension calculated by the flowmeter. Then the transducers are mounted into the blocks. Figure 27 below shows the short and long blocks.

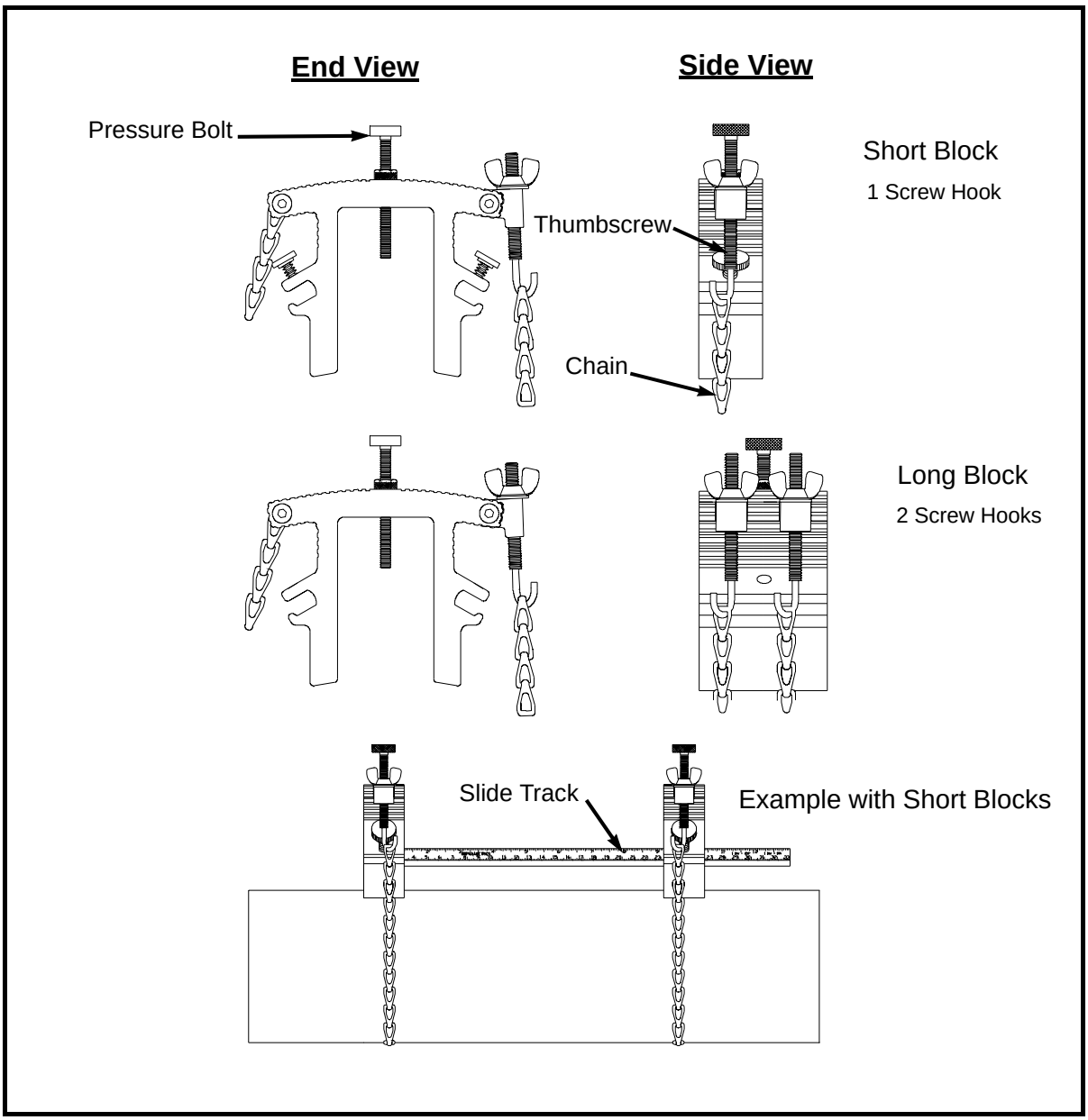


Figure 27: Components of Short and Long Blocks

Using the Universal Clamping Fixture (cont.)

Before you begin the installation, make sure you note the following restrictions for your clamping fixture. The universal clamping fixture is available in two lengths, 12- and 24-in. Each size fixture can be installed for a single- or double-traverse method. However, depending on the method used, there are pipe size restrictions that are outlined in Table 2 below.

Table 2: Clamping Fixture Pipe Sizes

Fixture Size	Single-Traverse Pipe Diameter	Double-Traverse Pipe Diameter
12-in. Clamping Fixture	2 - 24 in.	2 - 12 in.
24-in. Clamping Fixture	24- 48 in.	12 - 24 in.

The transducer installation consists of mounting the clamping fixture to the pipe and then mounting the transducers into the fixture. Refer to the appropriate section for instructions on either the double- or single-traverse methods.

The Double-Traverse Method

Note: *The instructions in this section can also be used for a multiple-traverse method. However, you must use an EVEN number of traverses. The distance the signal travels from one side of the pipe wall to the opposite side of the pipe wall is considered one traverse. For more than two traverses, consult the Panametrics factory.*

There are two advantages in using the double-traverse method. First, accuracy is improved because the signal is in the fluid longer than with a single-traverse. Second, if the there is enough pipe length available, the double-traverse fixture is easier to install.

The procedure for mounting the clamping fixture involves setting the transducer spacing and fastening the clamping fixture on the pipe. Please note you will only need the short block assembly for a double-traverse installation; the long block is not used.

IMPORTANT: *To set the spacing for the transducers, you will need to obtain the spacing dimension S, which the flowmeter automatically calculates from user-entered pipe and fluid parameters. Please refer to the programming procedure in the body of your manual. It is best to do this before installing the transducers.*

The installation procedure for transducers using the double-traverse method is as follows:

1. Be sure the location you have chosen for the installation has at least 10 pipe diameters of straight, undisturbed pipe upstream and 5 pipe diameters downstream of the measurement point.

2. Prepare the pipe where you intend to place the clamping fixture by making sure it is clean and free of loose material. Sanding, though usually not required, may be necessary to take off any high spots. However, be careful to preserve the original curvature of the pipe.

3. Obtain the transducer spacing dimension S, as described in the programming section of your manual. Using the attached ruler, move the blocks so they are a distance S from each other. Use the pressure bolt or the ends of the blocks as reference points. See Figures 24 and 25, page 20.

4. Position the clamping fixture along the **horizontal plane of the pipe, not on the top or bottom**. Make sure the chains on both blocks are on the same side of the fixture and are opposite the ruler.

5. Wrap the chain around the pipe and fasten the chain on the J screw hook on the opposite side of the block. Do this for both blocks.

The Double-Traverse Method (cont.)

6. Using the screw hook on the blocks, tighten the chains until the fixture is secured snugly to the side of the pipe.

Note: *Make sure the chains are perpendicular to the clamping fixture and are not twisted. If the chains are slanted, the slack may cause the fixture to move around. The slack may also change the transducer spacing after the transducers are mounted.*

Figure 28 below shows a completed double-traverse installation. The next step is mounting the transducers. (See page 31)

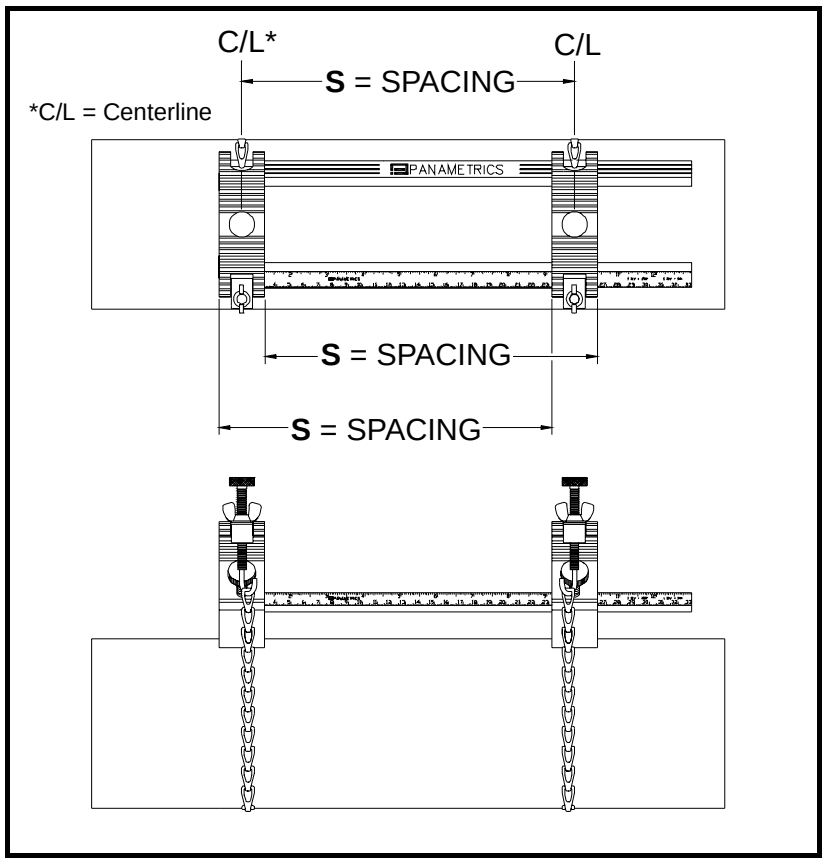


Figure 28: A Completed Double-Traverse Installation

The Single-Traverse Method

Note: *The instructions in this section can also be used for a multiple-traverse method. However, you must use an ODD number of traverses. The distance the signal travels from one side of the pipe wall to the opposite side of the pipe wall is considered one traverse.*

The procedure for mounting the clamping fixture for the single-traverse method requires a long block and two short blocks. The long block is fastened to the pipe first and then the short block assembly is properly aligned and fastened at 180° from the long block.

Use a center level punch for pipes to locate the transducers on the pipe. Do the following:

1. Prepare the pipe where you intend to place the universal clamping fixture by making sure it is clean and free of loose material. Sanding, though usually not required, may be necessary to take off any high spots. However, be careful to preserve the original curvature of the pipe and not to eradicate the marks on the pipe.

2. Use a level to find the top of the pipe and then draw a line along the pipe's axis.

3. Make two marks on the line separated by the transducer spacing distance S, as calculated by the meter.

4. From one of the marks, measure around the circumference of the pipe a distance equal to one quarter the pipe's circumference (Figure 29 below). Use the center punch to make a mark

5. From the other mark, go in the other direction around the pipe for one quarter the circumference and use the center punch to make another mark.

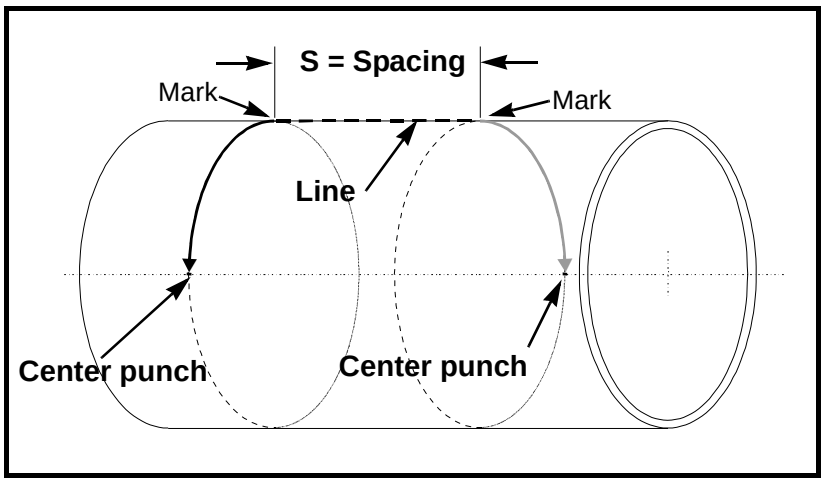


Figure 29: Center Punch Marks.

The Single-Traverse Method (cont.)

6. Center the long block over one of the center punch marks on the pipe. Align the long block so that the pressure bolt is over the center of the mark. Fasten the block by wrapping both chains around the pipe and fastening the chains to the screw hooks on the opposite side of the block (Figure 30 below).

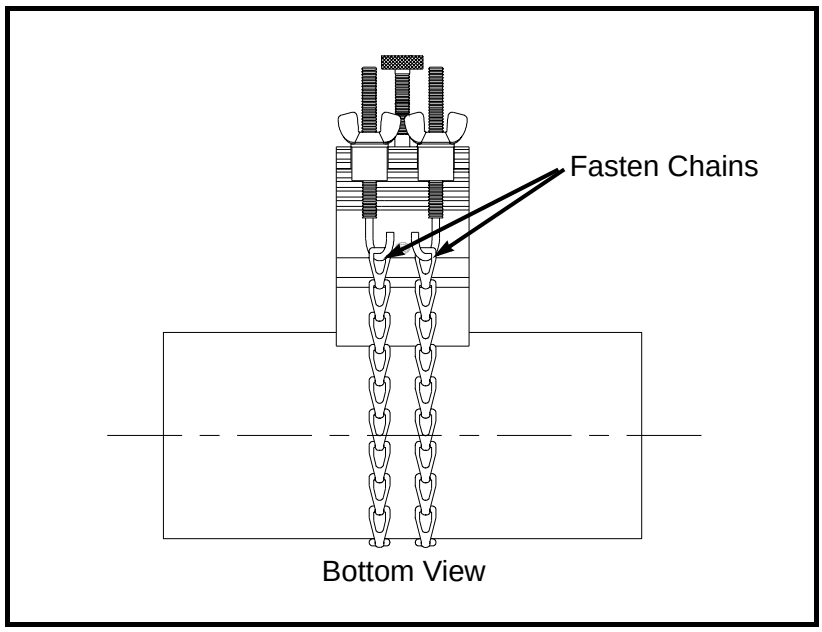


Figure 30: Long Block Fastened with Chains

7. Use the wing nuts to tighten the chains on the long block until it is secured snugly to the pipe.

Note: *Make sure both chains are perpendicular to the bottom of the block and are not twisted. If the chains are slanted, the slack will cause the block to slide.*

The Single-Traverse Method (cont.)

8. Position the clamping fixture rails so that the right block is placed over the remaining center punch mark on the opposite side of the pipe and the pressure bolt is over the center of the mark. Make sure the block does not lie on top of the chains of the long block. Use Figure 31 below as a reference. The left block may be placed on either side of the long block chains.

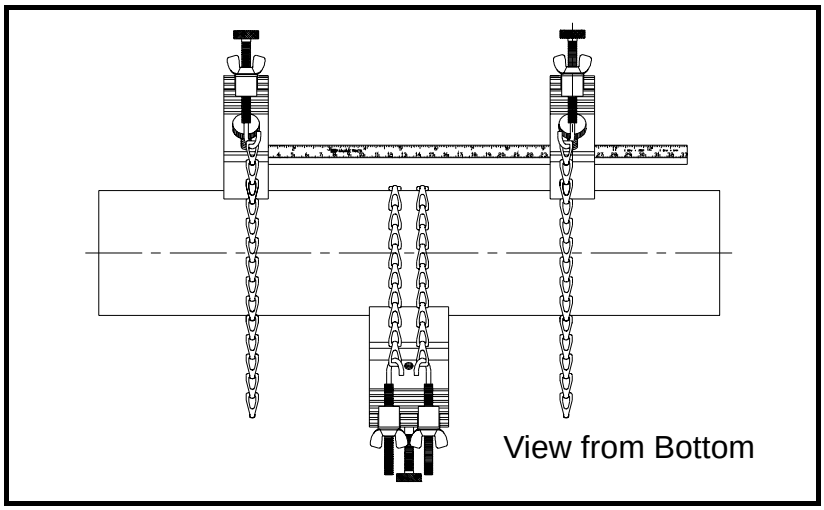


Figure 31: Short Blocks Placed Opposite Long Block

9. Wrap the chain around the pipe and fasten the chain to the screw hook on the opposite side of the block. Do this for both short blocks (Figure 32 below).

Note: *Make sure the chains on both blocks are on the same side of the fixture and are opposite the ruler.*

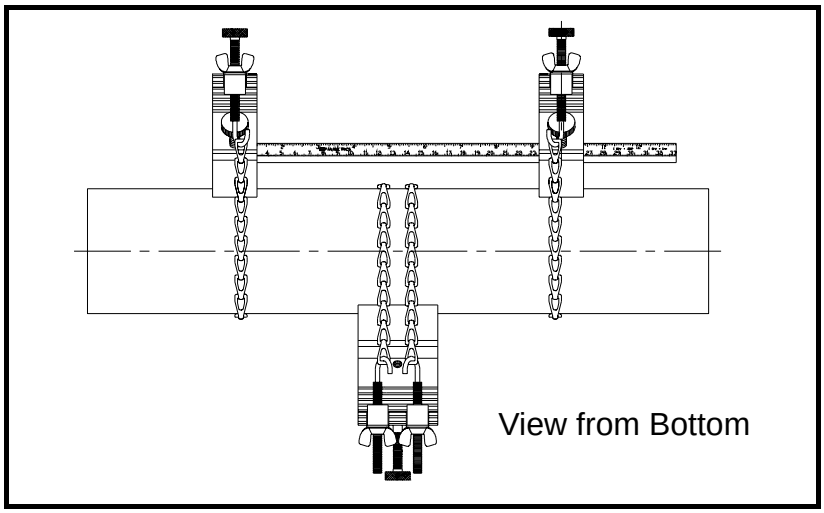


Figure 32: Long and Short Blocks Attached to Pipe

The Single-Traverse Method (cont.)

10. Use the screw hooks to tighten the chains on the left and right blocks until the blocks are secured snugly to the pipe.

Note: *Make sure both chains are perpendicular to the clamping fixture and are not twisted. If the chains are slanted, the slack will cause the blocks to slide.*

Figure 33 below shows a completed single-traverse installation. The next step of the installation is mounting the transducers (see page 32).

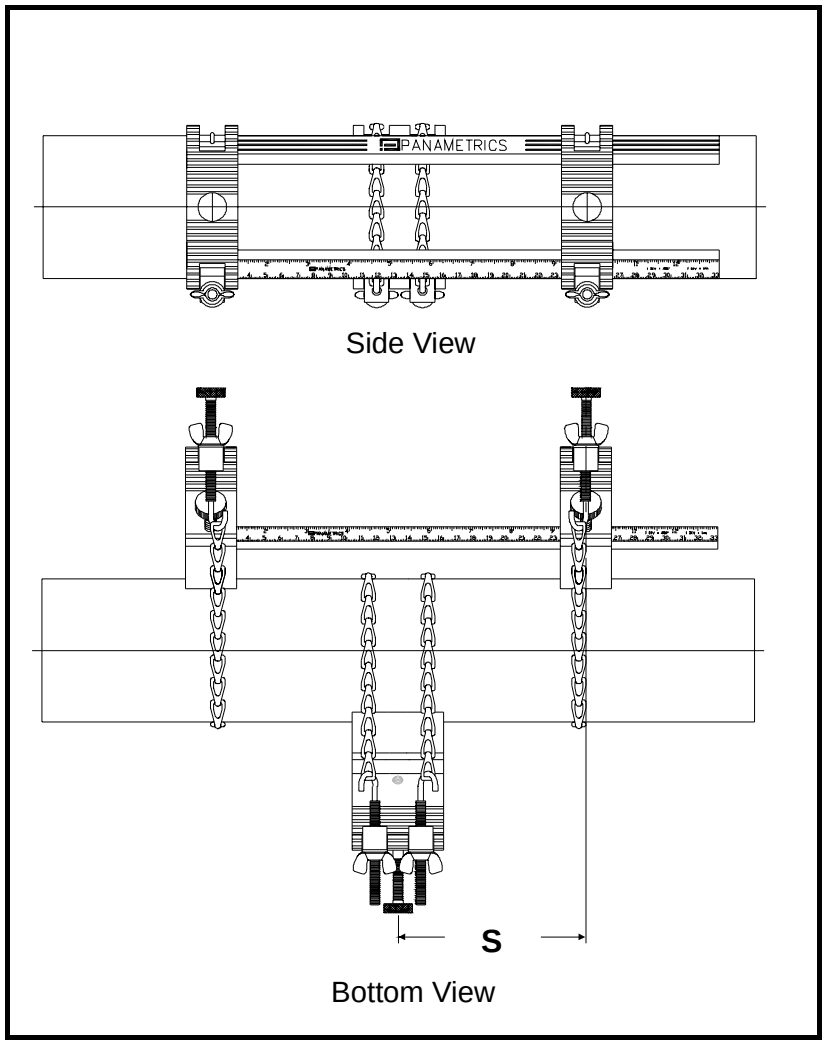


Figure 33: Completed Single-Traverse Installation

Mounting Transducers into the Clamping Fixture

The last step of the installation is mounting the transducers into the clamping fixture. Although not all transducers are installed exactly the same way, the following information provides some general guidelines to help you.

All transducers are manufactured with some kind of dimple, depression, or drill point. In addition, some transducers also have scribe marks. Generally, the face of the transducer, where the ultrasound is emitted, is opposite the dimple. When mounting the transducers, keep in mind that the face of the transducer makes contact with the pipe.

The dimples are used as a guide for both aligning and securing transducers. For transducers with both markings, you should match the dimple and use the scribe marks on the side of the transducers for setting the spacing. Figure 34 below shows some typical characteristics for the two most commonly used transducers.

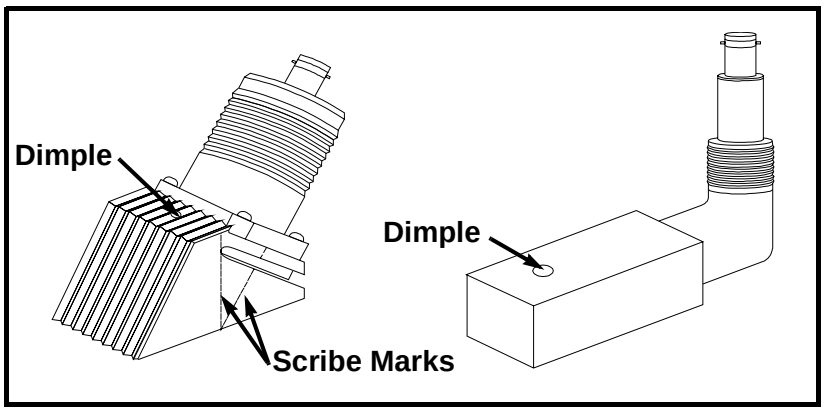


Figure 34: Transducer Dimples/Scribe Marks

Mounting Transducers into the Clamping Fixture (cont.)

To mount the transducers into the universal clamping fixture, use the following steps:

1. Before mounting, you may choose to connect the cables to the transducers (Figure 35 below). Refer to the Transducer Connection section in your manual.

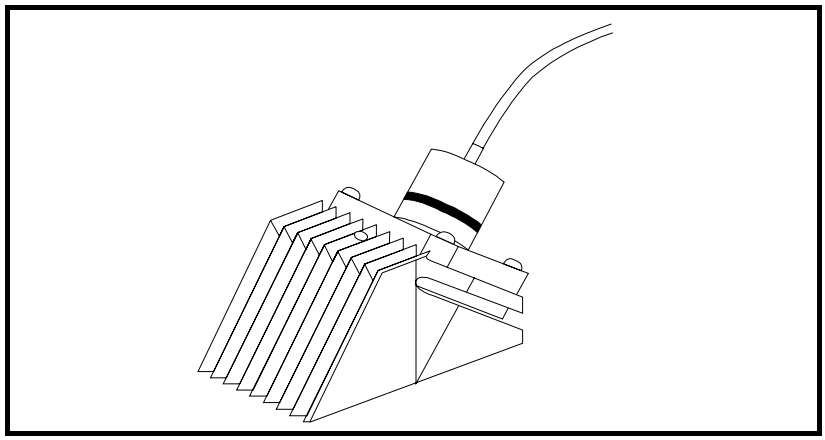


Figure 35: Cable connected to the Transducer

2. Take one of the transducers and apply a thin bead of couplant down the center of its face approximately the size of a toothpaste bead (Figure 36 below).

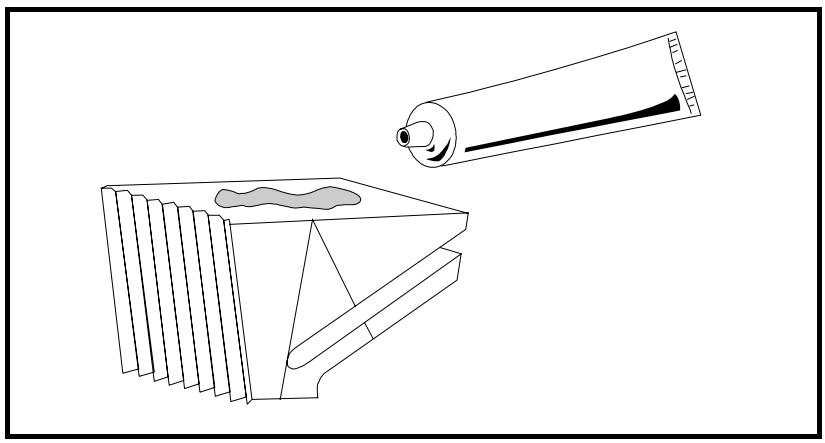


Figure 36: Apply Couplant to Face of Transducer

Mounting Transducers into the Clamping Fixture (cont.)

3. Refer to Figures 37 and 38 next page for completed installation drawings for the single- and double-traverse methods. Determine the upstream and downstream directions of the pipe and place a transducer into the right block. Make sure the transducer cable connector faces away from the center of the installation, as shown.

4. Use the pressure bolt to secure the transducer in place. The pressure bolt should fit into the dimple. Hand-tighten enough to hold the transducer in place.

5. Repeat steps 1 - 4 to mount the other transducer in the remaining block.

6. Connect the cables to the transducers, if not already in place.

Note: *If not already done, connect the other end of the transducer cable to the appropriately marked connector on the flowmeter unit. Refer to the Installation Section in your manual.*

Mounting Transducers into the Clamping Fixture (cont.)

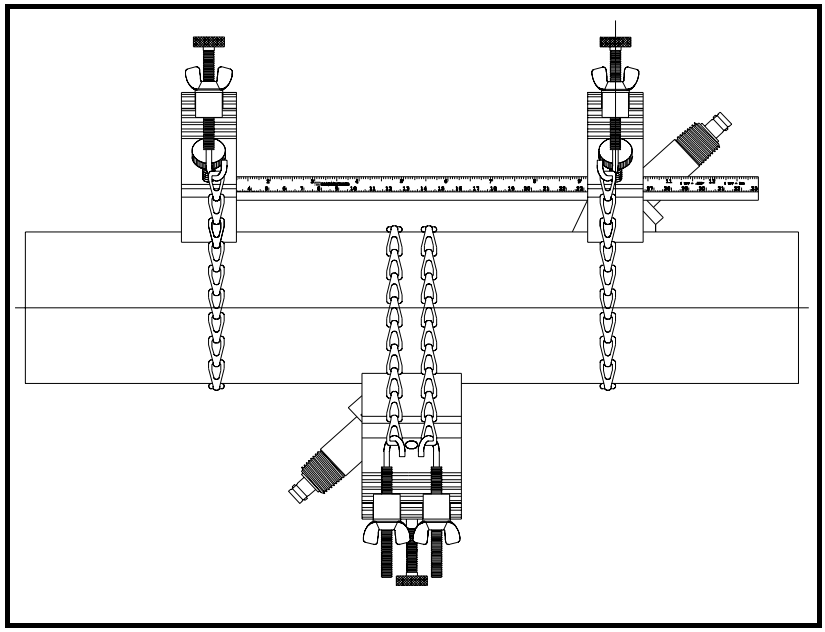


Figure 37: Completed Single-Traverse Method Installation

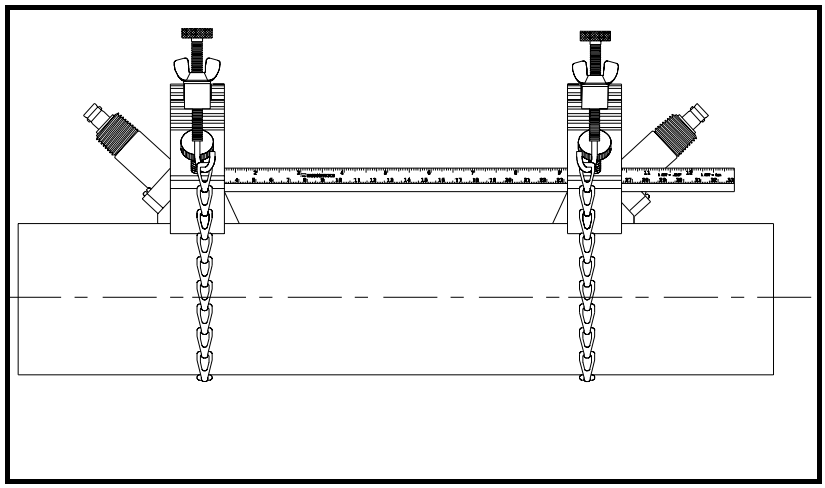


Figure 38: Completed Double-Traverse Installation

Note: *If you have mounted the transducers into the clamping fixture properly, the two transducer cable connectors will face away from each other as shown in these figures.*

Using the Small Pipe Clamping Fixture

Small pipe clamping fixtures are used for pipes from 1/2 in. to 2 in. (12.5 to 50 mm) in diameter and come with #24 or #23 transducers already installed. See Figure 39 below.

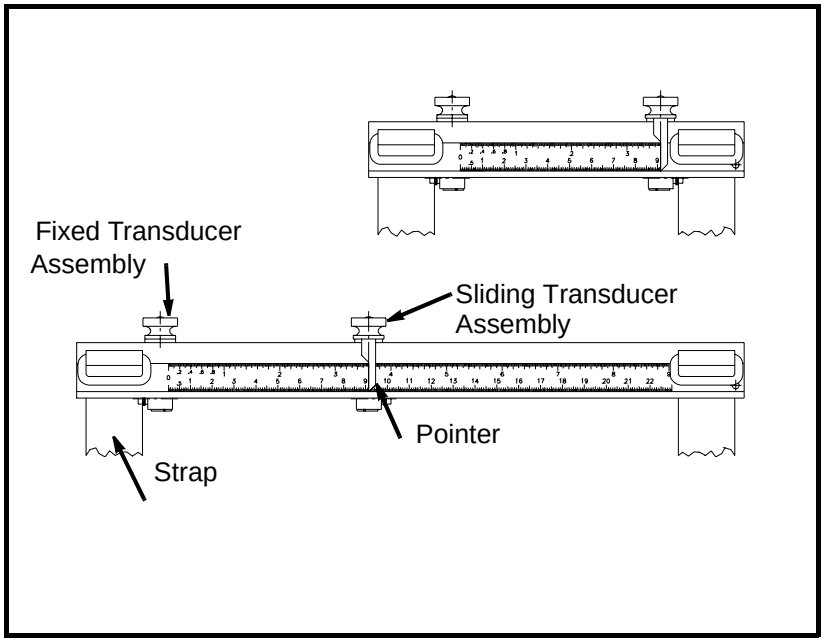


Figure 39: Small Pipe Clamping Fixture

The Small Pipe Clamping Fixture measures flow using the double-traverse method. However, you can use four traverses if desired. Do not use the single-traverse method (or an odd number of traverses) with the Small Pipe Clamping Fixture.

The Small Pipe Clamping Fixture consists of:

- Two Velcro straps
- Two sets of stainless steel straps
- One fixed transducer assembly
- One sliding transducer assembly with a pointer
- A ruler

Using the Small Pipe Clamping Fixture (cont.)

Before beginning, be sure the installation location you are using has at least 10 diameters of straight, undisturbed pipe upstream and 5 diameters downstream from the installation point.

The installation procedure for transducers using the small pipe clamping fixture is as follows:

1. Obtain the transducer spacing dimension S as described in the programming section of your manual.

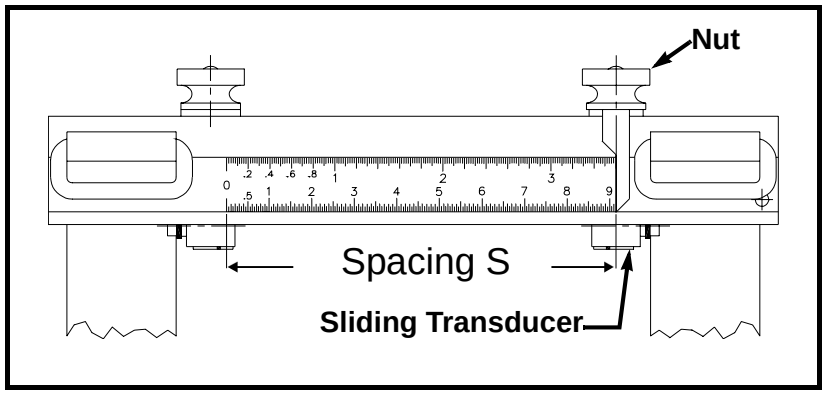


Figure 40: Small Clamping Fixture with Sliding Transducer

2. Set the sliding transducer to the specified spacing by loosening the nut a half turn on the sliding transducer assembly. Use the pointer to align the sliding transducer and then secure the transducer by tightening the nut (Figure 40 above).

3. Apply a thin bead of couplant to each transducer face. The couplant should not ooze out from underneath the transducer face.

4. Position the clamping fixture along the length of the pipe making sure the upstream and downstream transducers are facing the right direction. **Do not place the clamping fixture on the top or bottom of the pipe.**

Caution!
If your pipe has a rough surface, do not rub the transducer face over the surface of the pipe, or you may damage the transducers.

Note: *The fabric Velcro straps can be used to a maximum temperature of 170°F (77°C). For higher temperatures, use the stainless steel straps.*

Using the Small Pipe Clamping Fixture (cont.)

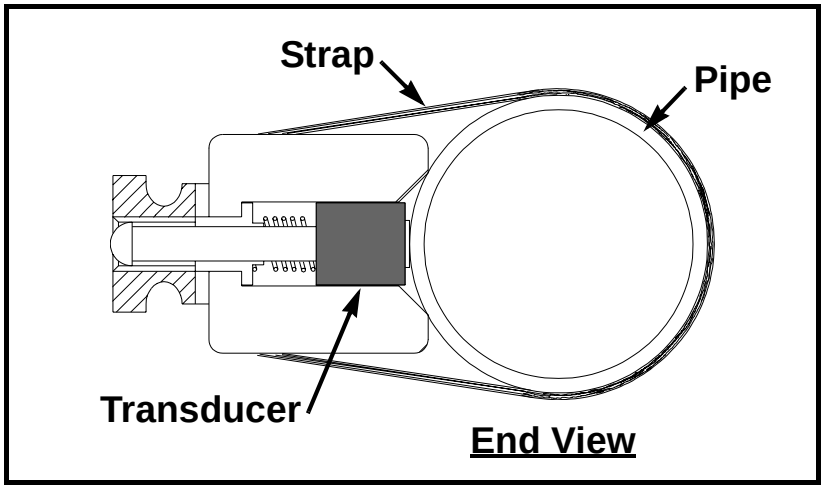


Figure 41: Small Clamping Fixture Installation

5. Using your hand, push the clamping fixture against the pipe and fasten the clamping fixture using the straps (Figure 41 above). Make sure the transducer cables are fed through the ends of the clamping fixture. If the cables are caught under the fixture, the transducers will not make contact with the pipe.

6. Connect the transducer cables to your meter as described in the Installation Section of your user's manual.

Yoke and Strap for CTS Transducers

Another type of clamping fixture is the yoke and strap (Figure 42 below). Although the yokes can be secured to the pipe with stainless steel straps, the yokes can also be welded. However, before welding, check the local codes, especially in pressurized vessel applications.

Use the following steps to install the yoke and strap clamping fixture:

1. Determine the transducer location by measurement and layout procedures. Transducers must be mounted with at least 10 diameters of straight undisturbed pipe upstream and 5 diameters downstream from the installation point.
2. Mount the yokes using the stainless steel straps. Back off the top pressure bolt and the side support bolts.
3. Mount the transducers in a horizontal plane.Transducer performance is sensitive to exact location. For a single-traverse installation, the transducers must be 180° from each other around the circumference of the pipe. Use the S dimension (supplied with your flowmeter, based on programming information) to figure the exact location of the transducers.
4. Install the transducers into the yokes.
5. Use the side support bolts and top pressure bolt to secure the transducers into the fixture.

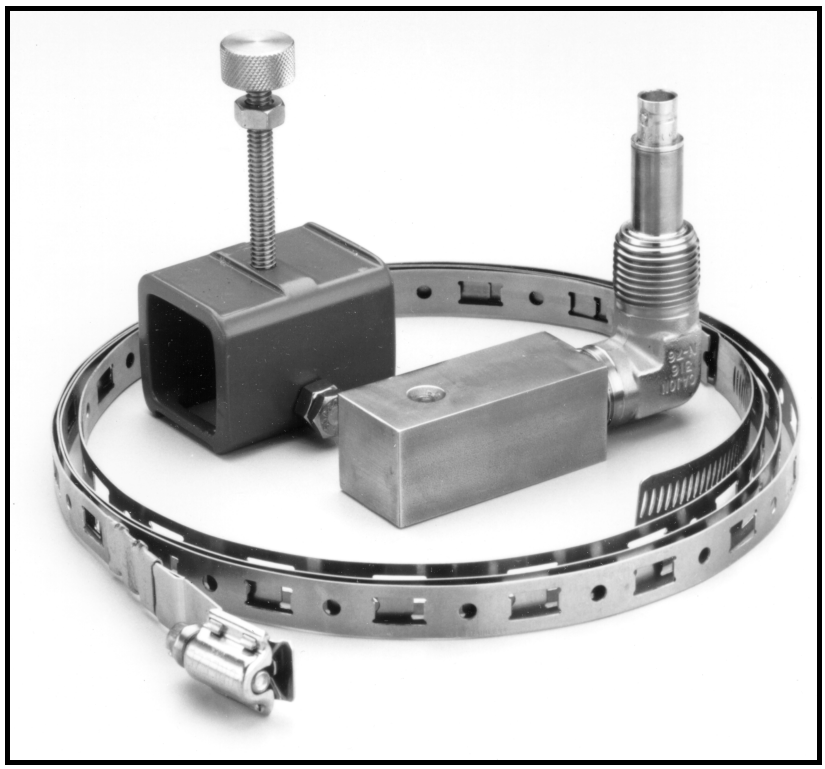


Figure 42: Strap, Yoke and Transducer

Using the Magnetic Clamping Fixture

The magnetic clamping fixture is used to fasten transducers to magnetizable pipe at the proper spacing. The single-traverse method requires two magnetic clamping fixtures. Each fixture consists of a transducer block and two magnetic blocks (Figures 43 and 44 below).

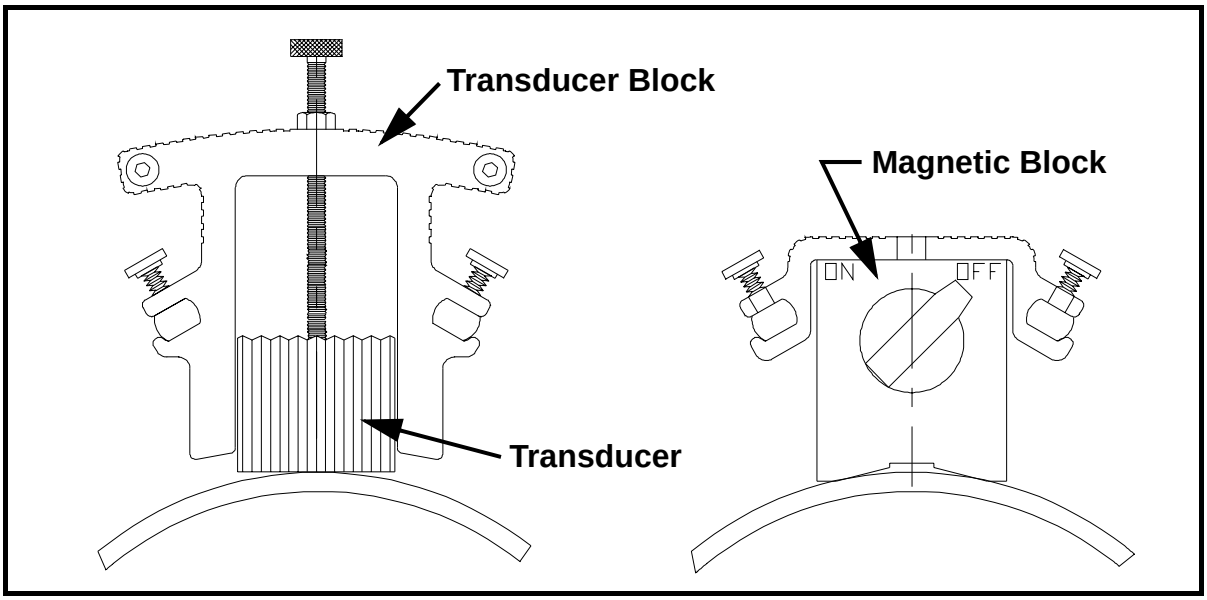


Figure 43: Transducer Bracket and Magnetic Block

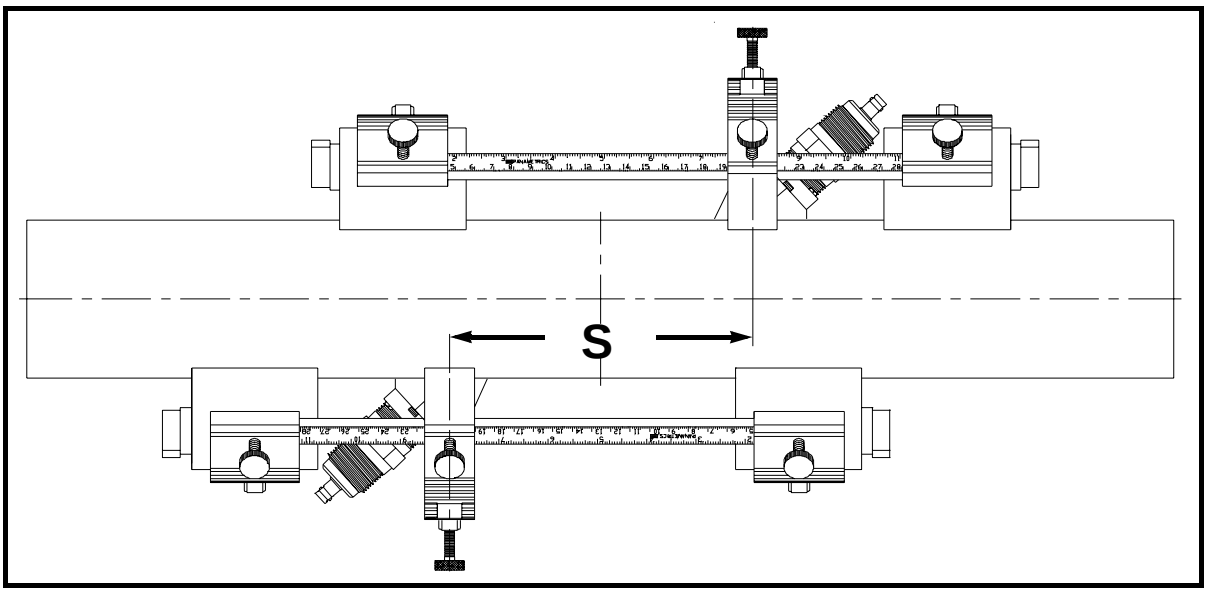


Figure 44: Single-Traverse Magnetic Fixture Installation

Using the Magnetic Clamping Fixture (cont)

The double-traverse magnetic clamping fixture (Figure 45 below) consists of two transducer blocks connected by rails. Each block holds a transducer on the same side of the pipe.

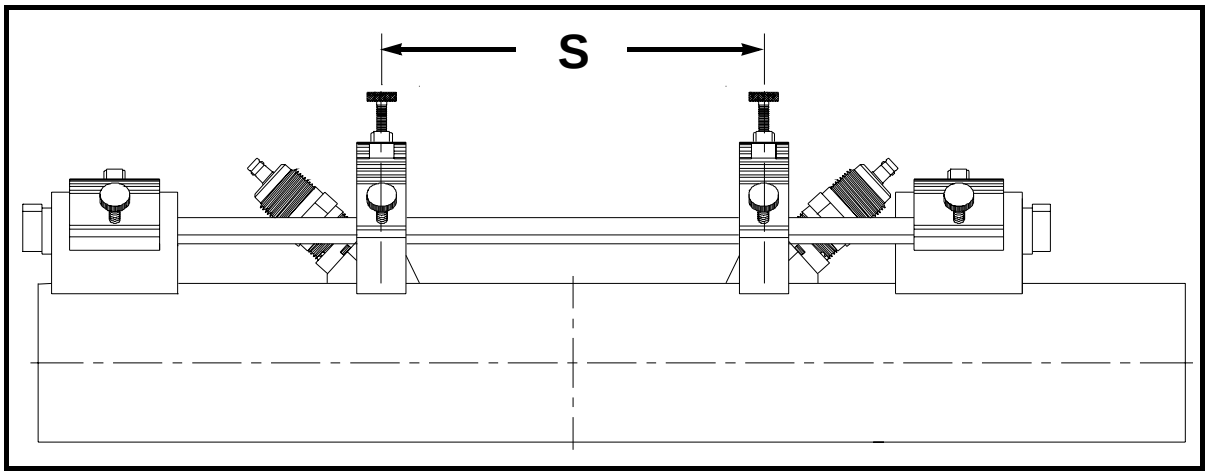


Figure 45: Double-Traverse Magnetic Fixture Installation

Using the Magnetic Clamping Fixture (cont.)

The procedure for mounting the magnetic clamping fixture involves setting the transducer spacing and then securing the fixture to the pipe. To set the spacing for the transducers, you will need to obtain the spacing dimension S, which the flowmeter automatically calculates from the user-entered pipe and fluid parameters. Refer to the appropriate section in your manual. It is best to do this before installing the transducers.

!WARNING!
Do not use magnetic fixtures at temperatures that exceed 120°F (49°C), or the fixture will fall off.

Before beginning, be sure the location you have chosen for the installation has at least 10 pipe diameters of straight, undisturbed pipe upstream, and 5 pipe diameters downstream from the installation point.

To locate the position of the transducer, use the pipe center punch method (page 28).

The installation procedure for the transducers using the double-traverse method is as follows:

!WARNING!
Do not tighten the transducer pressure bolt so that the magnet separates from the pipe. The fixture is heavy and may fall if separated from the pipe. A safety tether or leash is recommended for elevated locations.

Using the Magnetic Clamping Fixture (cont.)

Note: *The instructions that follow can be used for a multiple-traverse method. However, you must use an EVEN number of traverses. The distance the signal travels from one side of the pipe wall to the opposite side of the pipe wall is considered one traverse.*

1. Prepare the pipe where you intend to place the Magnetic Clamping Fixture by making sure it is clean and free of loose material. Sanding, though usually not required, may be necessary to take off any high spots. However, be careful to preserve the original curvature of the pipe.

2. Obtain the transducer spacing dimension S, as described in your manual. Using the scale on the rod, move the adjustable block to the specified location.

Note: *Use the pressure bolt as the measuring point for the bracket. Position the bracket on the ruler so that the pressure bolt is right above the spacing dimension S.*

3. Locate the magnetic blocks at least 4 in. away from the transducer blocks. This will ensure that there is enough clearance to mount the transducer in the blocks.

4. Position the clamping fixture along the horizontal plane of the pipe. If the pipe is horizontal, do not place the fixture on the top or bottom.

5. Turn the switches on each magnet to the ON position.

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